ELECTRICAL REVIEW

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VIEWS, NEWS AND INTERVIEWS

Mr. L. G. Martin, of Bermuda, who was manager of the cable office at Kingston, Jamaica, during the Spanish-American war, is mentioned in the official navy records in the following complimentary terms by Capt. C. S. Cotton, commanding the U. S. S. "Harvard":

"The manager of the Direct West India Cable Company at Kingston, Mr. Martin, was most attentive and polite, rendering every assistance in his power to facilitate the delivery and transmission of our dispatches during our stay, by giving our business his personal supervision at night as well as during the day."

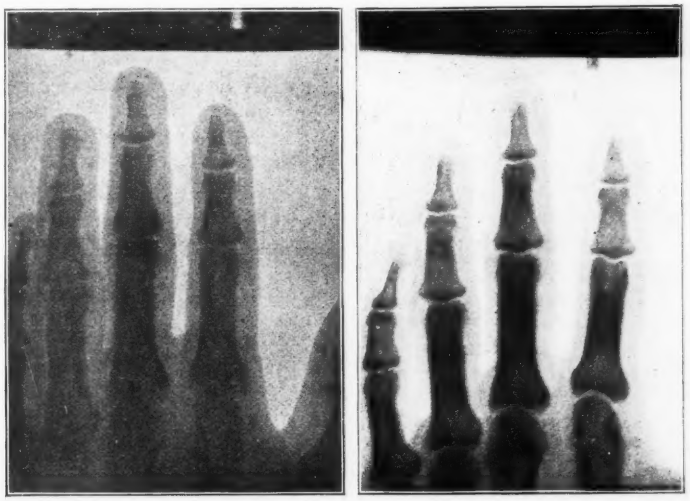
A newspaper cablegram from Allahabad, India, asserts that it is understood that the British Government's new central gun-carriage factory, which will be built at Jabalpur to replace the existing factories at Fatehgarh, Madras and Bombay, will probably utilize electric power, which will be generated at the Nerbudda Falls, nine miles away.

Arthur Lewis, brother of Miss Julia Arthur, the actress, has returned from Europe, and is enthusiastic about automobiles. "I have studied this matter carefully," he said to a New York reporter, "and watched the progress of invention, and I feel certain that the day of automobiles has come. It is a great industry to-day, and it will be a great one in the future. After a careful study of the various kinds I am convinced that an electrical motor is far and away the best, and that the American manufactured machine will surpass any foreign makes. We are a little new and crude yet, but we have the right idea, and I expect to see our automobiles lead the world." Mr. Lewis, it is reported, has just organized a company for the manufacture of these machines in Boston.

Although the trolley strike has been a fizzle, it has resulted in the complete tie-up of the only horse car line in Brooklyn and Long Island city, says the New York *Sun*. Michael Connors, 60 years old, has been an employé of the road for more than 30 years. He was one of the drivers of its original "bobtail" cars of long ago. When the trolley system was adopted Connors said that he was too old to learn how to use a motor. He was accordingly allowed to run a "bobtail" car from the terminal of the Crosstown Road to the Long Island City Ferry, a distance of about half a mile. He owns his own horse and his car is stabled in the Crosstown barn. He received $2 a day from the railroad company, which doesn't care whether he makes one trip a day or 10, as he is employed, it is said, only on account of his long connection with the road. Since the strike he has not appeared at the station to take out his car, and it is supposed that he is holding a sympathy strike of his own. Here is a road in which the entire line is blocked and the entire force out on strike.

The newest use for an electromobile in New York city is as a wedding coach. One was observed last week profusely decorated with white ribbons, just as the old horse carriages used to be.

The officers of the cable steamer "Minia", of Philadelphia, which is now endeavoring in midocean to locate and repair a broken cable 1,500 feet below the surface of the water, state that their instruments show the bottom of the ocean to have a temperature below the freezing point, and that there is a total absence of light. At this depth the pressure is estimated at about a ton to the square inch in every 1,000 fathoms. The officers say that a great many of the deep-sea fish are so peculiarly constructed that they often lose their lives by chasing the instruments toward the surface. They die by "falling upward." As soon as they get out of their accustomed level the decreased pressure extends the air within them, and the fish shoot to the surface, but are dead before they reach that point.



ONE INTERRUPTION. SIXTEEN INTERRUPTIONS.

INSTANTANEOUS RADIOGRAPHS MADE WITH THE CALDWELL INTERRUPTER AND CALCIUM TUNGSTATE SCREEN.

A dispatch from Melbourne says that the Eastern Extension Telegraph Company has made an offer to the Victorian Government to lay a cable from Australia to South Africa without cost to the colonies. The company requires neither a subsidy nor a guarantee.

"Timson," formerly a feline Angora de Bergerac, living on a farm near St. Louis, is now a feline Beau Brummell. A smudge of yellow hair on his otherwise white face has been removed by electricity.

INSTANTANEOUS RADIOGRAPHS.

BY E. W. CALDWELL.

The long exposure necessary to obtain a good radiograph is in many cases a serious disadvantage. It is always desirable to make the exposure as short as possible in order to prevent the picture from being blurred by a movement of the subject, and to lessen the danger of producing an X-ray burn.

Ordinarily it is necessary to make an exposure of from one to three minutes to obtain a satisfactory radiograph of the hand of an adult. In the accompanying illustrations are shown two radiographs of a hand which were made with very short exposures, and which illustrate a new method of measuring the time of exposure. The radiograph shown at the right was made with an exposure of about sixteen thirty-fourths of one second, and the radiograph at the left was made with a single discharge of an induction coil, the duration of which was probably less than one five-thousandth of one second. These pictures were made without employing any new or unusual methods, but it was of course necessary to use very efficient tubes and exciting apparatus, and to develop the negatives with care.

The exciting apparatus used consists of a good oil-insulated induction coil, capable of delivering a 12 or 14-inch spark, and a liquid interrupter giving about 34 breaks per second. Current from the Edison mains at 117 volts was used for operating the coil. The tube was of a special form made under the supervision of Mr. W. H. Meadowcroft of the General Electric Company.

The negatives were made on celluloid films, which were laid face down upon a tungstate of calcium screen. (The celluloid films offer much less obstruction to the X-ray than glass plates, and the above arrangement, therefore, utilizes the fluorescent screen to the best possible advantage.)

The arrangements for measuring the length of the exposures were as follows: A ribbon of one-sixteenth inch sheet lead, one and one-half inches wide, and about 18 inches long,

having a small slit cut about the middle of its length was arranged to be moved by hand across the photographic film. Attached to the lead ribbon was a sliding contact which closed the primary circuit of the induction coil, while the slit in the middle of the ribbon traversed a distance of three inches across the end of the photographic film. By moving the lead ribbon faster or slower across the film the length of the exposure could be varied at will, and since the moving slit occupied a new position at each discharge of the induction coil, the number of discharges of the coil during the exposure corresponds to the number of photographic images of the moving slit. The frequency of the interrupter was ascertained to be about 34 breaks per second, and the interval between any two images of the slit, therefore, represents about one thirty-fourth of one second.

With this apparatus I have made a large number of fairly good radiographs of a hand, with exposures varying from a single discharge of the coil to one second. The fluorescent screen materially increases the photographic effect upon the sensitive film, but it gives the pictures a mottled appearance which is very objectionable.

[It is to be regretted that the 16 faint images of the slit shown on the original of the right-hand radiograph reproduced in the illustration are not discernible in the half-tone reproduction. — EDITOR ELECTRICAL REVIEW.]

Crooked Italian Lightning.

One of our Italian contemporaries, *L'Elettricità*, relates the following story about a lightning stroke:

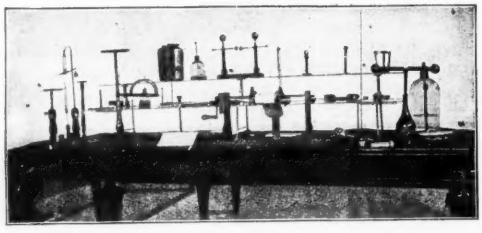
"Last Sunday lightning struck with great violence in the principal street of Tricerro, striking the point of an umbrella which a man named Dellocchio was carrying in his hand while he stood for shelter beneath a portico. The lightning traversed the umbrella stick, went across the portico, along the house, through a door which opened into a ground-floor room where were sitting at a table 10 persons composing the Pretti and Mentizzi families. The lightning touched none of them, but made the circuit of the table, went out by the opposite door into the courtyard, up the rain-spout and along the ridge of the roof, and, following a telegraph wire, struck to earth down two telegraph poles in Dessana street several blocks away. Nobody was hurt."

VOLTA RELICS DESTROYED.

FIRE AT THE COMO, ITALY, ELECTRICAL EXPOSITION DESTROYS VALUABLE RELICS OF THE GREAT ITALIAN SCIENTIST.

On July 8 a fire broke out at the Volta Electrical Exposition, at Como, Italy, where there were gathered together not only many relics of Alessandro Volta, but also a large amount of electrical machinery illustrating the progress of the electric arts during the last century. Although the relics of Volta, including much of his experimental apparatus, were stored in a solid masonry receptacle, they were nearly all destroyed. Practically nothing was saved, except a few personal relics, including the senatorial sword presented to him by Napoleon I and his various medals and decorations.

ALESSANDRO VOLTA.
From an Engraving by Morghen.



SOME OF VOLTA'S APPARATUS EXHIBITED AT COMO.

ONE OF THE TABLES USED BY VOLTA IN HIS EXPERIMENTAL WORK.

The exposition was in commemoration of the 100th anniversary of the invention of the electric battery by Volta. This illustrious electrician was born at Como, on February 18, 1745, in a house that had been occupied by his family for over three centuries and a quarter. His parents were members of the lesser aristocracy of Italy, but his father had wasted his patrimony in various excesses and, at the time of his birth, the family was comparatively poor. Of the seven children all but two embraced religion, two of his sisters being nuns and three of his brothers priests of the Catholic Church. It is related of the childhood of Alessandro Volta that he developed so slowly that it was feared he was an imbecile. It was not until his fourth year that he began to talk, but his subsequent progress was very rapid, and even in childhood he showed an almost marvelous power for observing natural phenomena and investigating their causes.

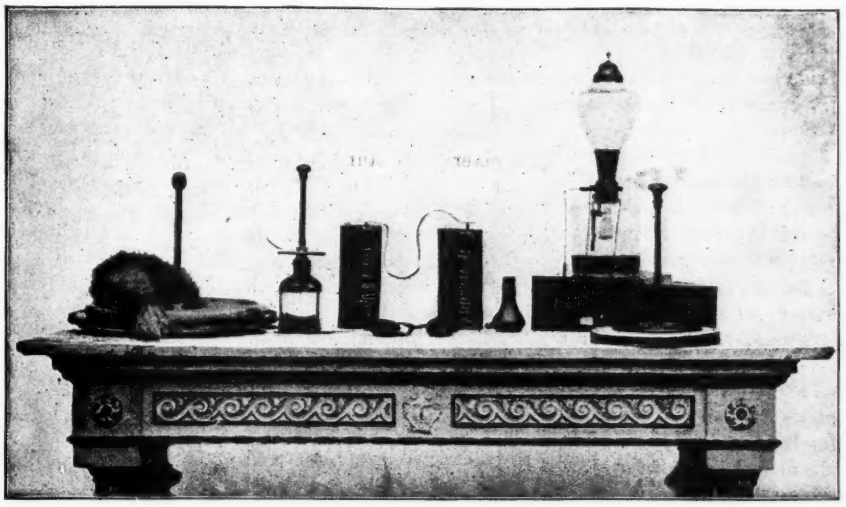
At the age of 13, he entered a school of rhetoric, where he showed an unusual aptitude for composing poetry. While still a youth, he wrote an elaborate poem of 800 verses on the seasons, using for this the Latin language. His education was further carried on in the College of the Jesuits in Rome, and in the Bensi Seminary, where his time was practically divided between the physical and natural sciences and poetry. Before he was 18 he had written an ode in French on the ascent of Mont Blanc. A little later, he was a regular correspondent of the famous Abbé Nollet, who gave him encouragement to publish accounts of his various researches and speculations in electricity. By the time he had attained the age of 26 years, he had already published several important memoirs on scientific subjects. In 1774, he was made a regent of the schools of Como, and in the following year he invented the electrophorus. This invention caused a considerable stir in the electrical world, and brought him many honors from numerous academical bodies, finally leading to his appointment as Professor of Experimental Physics in the gymnasium at Como. Here he introduced an innovation in methods of teaching by using the Italian language instead of Latin in the writing of theses and exercises. Up to that time it had been the custom to use the learned language in the preparation of philosophical documents, but Volta felt that the physical truths which were to be demonstrated by experiments, the directions for the use of apparatus and the manipulation of the same could be much more clearly set forth to his students by the use of the vernacular.

It appears that during the next few years much of his attention was directed to the study of chemistry, at that time a growing and vigorous science. He invented the inflammable-air pistol, the hydrogen lamp, the eudiometer and much other philosophical apparatus of the same character. Traveling to Switzerland in his thirty-second year he was received with much honor by the Academy of Physical Science in Zurich, and, in the following year, was called to the chair of physics in the University of Pavia. It was about this time that he published his memoir on the capacity of conductors, and invented the condenser. It seems that during the next five years he traveled extensively, visiting the various capitals of Europe, making the acquaintance of many of the scientists of his time, among whom were Benjamin Franklin, Buffon and Lavoisier. His journey ended in London, where he read his paper on the condenser before the Royal Academy, which presented to him the Copley gold medal. Returning to Italy he visited the court of the Emperor Joseph II in Germany, where he again received decorations for his scientific work.

Upon his return to Italy he found that the discovery of Galvani upon the effect of artificial electricity on animal organisms was attracting much popular attention. This led Volta back to his electrical studies, with the result that, having carefully considered all that Galvani had done, and disagreeing with his conclusions, he saw a new source of electricity in the contact of dissimilar metals. The in-

vention of the electric battery was a consequence.

This first battery consisted of a pile of alternate silver and zinc disks, separated by disks of cloth, moistened with brine or acidulated water. On the terminal disk were ears for the convenient attachment of wires. With this simple apparatus the decomposition of water, the electric spark and many of the familiar manifestations of current electricity were first exhibited.



VOLTA'S APPARATUS INCLUDING THE ELECTROPHORUS, THE PILE AND THE ELECTROSCOPE.

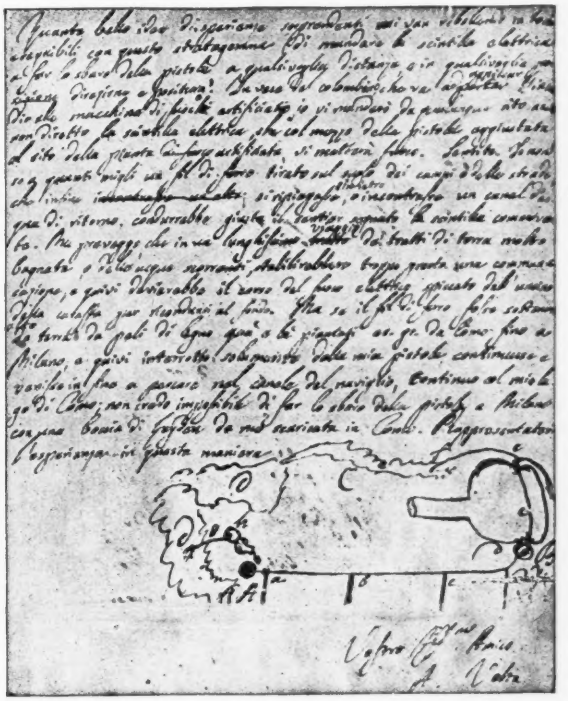
Throughout the remainder of his life Volta was the recipient of much honor and respect. His position was that of the foremost scientist of his day. In Geneva, in Paris, and in other cities he was received as the most eminent exponent of the physical sciences—then the leading matter of interest. Upon his appearance in Paris, Napoleon, then the First Consul, attended the meeting of the institute at which Volta's paper upon the electric battery was read and his experiments repeated. Here the future emperor spoke, as a member of the institute, of the debt of gratitude owed by science to the illustrious inventor, and proposed that he should receive a gold medal. Not content with this, the First Consul presented the Italian inventor with the sum of 6,000 lire, an annual allowance, a knighthood of the Legion of Honor, the medal of the Iron Cross, and made him a Senator and a Count of France.

The closing years of Volta's life were passed at Como and in his villa at Camnago. He lived to the great age of 82 years, his mind remaining clear till the last, and kept up a constant correspondence with the scientists of his time. His death took place on March 5, 1827, and his remains were interred in the cemetery at Camnago. In 1851 they were removed to the tomb shown in one of the accompanying illustrations.

Little is known of Volta's private life, except that it was exemplary in all details. He was married in 1794 to a lady of a noble Italian family, and left three sons. The greater part of his experimental apparatus had been preserved in various institutions of learning in Italy, and most of them were exhibited at the ill-fated exposition in his native Como.

VOLTA'S TOMB AT CAMNAGO.

Through the courtesy of the *Scientific American*, several illustrations of Volta's experimental apparatus, a fac-simile of a manuscript letter by him, his portrait and a picture of his tomb are shown herewith.



FAC-SIMILE OF AN AUTOGRAPH LETTER BY VOLTA, CONCERNING ELECTRIC WAVES.

Electromobiles in Berlin.

Several independent attempts are being made to introduce electrically propelled omnibuses on the Berlin streets. Siemens & Halske have just constructed an experimental omnibus on the perambulator principle with two steering wheels, so that it can run on street-railway tracks. It is also equipped with a collector, which enables its accumulators to be charged from the overhead trolley wires during a journey over the tracks. The vehicle is designed for a maximum speed of 28 kilometres per hour, its battery sufficing for a six-kilometre run on one charge.

Lord Kelvin to Resign His Professorship.

It is stated by the London correspondent of the *Glasgow Herald* that Lord Kelvin, who is at present in London, intends immediately to resign the chair of Natural Philosophy in Glasgow University.

New Process For Forming Accumulator Plates.

The *Elektrotechnische Rundschau* reports the proposed erection of a factory at Brussels for the forming of accumulator plates by the Vuillot process. This process consists in transforming the surface, or in some cases, the whole thickness of the positive plates into carbonate of lead, whereupon the plates are placed as electrodes in an alkali bath, which serves to reform the lead, at the same time giving it the desired spongy modification. First of all, the lead plates are exposed to an atmosphere impregnated with carbonic acid, which in its action partially or completely transforms them into carbonate of lead. Then they are steeped in an alkali bath (for instance, a solution of ammonia), in which they are subjected, as an active medium, to the secondary influence of electrolysis, which in a few hours transfers to the plates the desired qualities. Plates formed in this manner are claimed to possess great strength and durability.

SCIENCE BREVITIES.

A New Station Day Load—M. Hospitalier, writing in *L'Industrie Electrique*, describes a suggestion made by M. des Carats for an entirely new use for current generated during the idle and light-load hours of a station. It is proposed that during these times the current should be sent through electrolytic cells in hotels, hospitals, laundries, etc., and the oxygen generated by the electrolysis of water used for the bleaching and cleaning of soiled clothes. To quote the author, "Ordinary bleaching methods are injurious to the fabrics. Chlorine and alkalies attack the cellulose. Oxygen, on the contrary, cleans and whitens without altering the fiber, and furthermore is a powerful antiseptic." This seems very interesting and perhaps not impractical. It would probably be worth while to try it.

Rays Emitted from an Electrified Point—M. S. Leduc published recently in *Comptes Rendus* some interesting researches upon rays emitted from an electrified point. A sharp point connected with either of the poles of an electro-static machine, the other pole being isolated emits non-luminous rays which affect ordinary photographic plates in a few seconds, or even ordinary photographic printing paper, which is much less sensitive. These rays seem to possess the properties of the violet and ultra-violet rays of the spectrum. Dr. Finsen, at Copenhagen, has shown the efficacious action of the ultra-violet rays of the spectrum in the treatment of certain skin diseases. The same action has also been attributed to the wind blowing from an electrified point. The production by the electrified point of the same character of rays used by Dr. Finsen is worthy of remark.

Carbon Oxidizing Batteries—In a paper lately communicated to the Royal Society, Mr. Willard E. Case describes a new form of carbon-consuming battery, in which a chloride of iron is used as a carrying agent for atmospheric oxygen which accomplishes the solution of the carbon. A single-fluid cell was constructed, having as a positive electrode finely powdered sugar-carbon in a porous cup from which the air was exhausted so far as possible before and after it was immersed in the cell containing a solution of ferric chloride. This, owing to the vacuum, filtered into the cup and filled it, thereby doing away in a great measure with the atmospheric oxygen present in the carbon. A platinized platinum sheet was used as the negative electrode. The electro-motive force was .2 volt. A similar cell containing a solid carbon in a solution of ferrous chloride gave electro-motive forces up to .06 volt, while a cell containing carbon in dilute ferric chloride solution and a platinum plate in concentrated ferric solution in a porous cup gave .1 volt. The theory of the cell is that the ferric chloride is reduced by the carbon to ferrous, parting with some of its oxygen, which enters into combination with the carbon to produce a gaseous product and that the ferrous chloride which is formed is again reduced to ferric by the oxygen of the air. In this way the iron salt is a carrier of the oxygen. The research is one that is deeply interesting and it is to be hoped that further work along the same line will be undertaken, as the author leaves many points unexplained and many interesting avenues of experiment unexplored.

A Simple Method of Testing Dynamos—In a recent number of the *Elektrotechnische Zeitschrift* M. Liebenow describes a very simple and rapid method of testing dynamos in order to determine whether any changes in the efficiency have occurred after a period of running, which consists of simply uncoupling the dynamo from the engine and running it as a motor, current for the purpose being taken from the bus-bars or direct from another machine until its speed of revolution has reached a given value, when the current is broken and at the same instant a stop-watch is started, and the time which the machine takes in gradually coming to rest is noted. If this is done when the machine is new, or at any other time when it is known to be working at its highest efficiency, then at any other time the condition of the dynamo as regards the internal losses may be determined by conducting a similar test for comparison with the standard. By making tests in this way, both with the fields excited and without, and also with the brushes on or off, an opportunity is afforded of testing the effect of each. Such tests will show: (1) Whether the bearings are in good order or not; (2) whether the brush friction has become abnormal—and, with the fields excited; (3) what are the Foucault losses (for under this condition the armature will come to rest sooner than with the field open, since the Foucault current losses will then be added to the friction losses in bringing it to rest). It may be pointed out that the method does not attempt to do more than show the relative efficiency of the dynamo, as to determine the actual value by such methods it would be necessary to know the moment of inertia of the armature, which in most instances would be a very troublesome quantity to determine. An attempt was made in this direction some while since, when the difficulty was met by repeating the test with and without a heavy flywheel, and from the results of these the actual efficiency was calculated. It is obvious that instead of measuring the time taken by the machine to come to rest after the current is broken, we may count the number of revolutions, and use these as our basis of comparison.

Uranium Radiation—The nature of the radiation emitted by uranium and its compounds has been investigated by Mr. E. Rutherford, with special reference to the electrical conduction produced, and the results published in the *Philosophical Magazine*. Very similar effects are produced in gases by uranium and Roentgen radiation. The author finds no evidence to show that polarization or refraction takes place; in this respect he differs from Becquerel, the discoverer of the uranium radiation, who concludes that polarization and refraction do occur. The theory of ionization, which supposes that the rays in passing through a gas produce positively and negatively charged particles in the gas, and that the number produced per second depends on the intensity of the radiation and the pressure, furnishes a satisfactory explanation of the electrical conductivity produced by uranium radiation.

Experiments are described which show that uranium radiation is complex. In it there are present at least two distinct types of radiation—one that is very readily absorbed, called by the author the α radiation, and the other of a more penetrative character, termed the β radiation. There are indications that the β radiation is approximately homogeneous; this type passes through the substances tried with greater facility than the α radiation. In experiments with different uranium compounds it was found that the amount of the α radiation depended chiefly on the surface of the uranium compound, while the β radiation depended also on the thickness of the layer. The rate of leakage of electricity between two metal plates kept at different potentials and placed four centimetres apart, on one of which metallic uranium or a compound of uranium was spread, was measured by means of an electrometer. The rate of leakage due to the β radiation is, as a rule, small compared with that produced by the α radiation. The α radiation is strongly absorbed by gases, while the β radiation is only slightly so. In the case of photographic action it is found that the β radiation is the effective variety. There is a great difference in the power of penetration of the two types of radiation. The transparency of aluminum for the β radiation is over 100 times as great as for the α radiation. The opacity of the metals aluminum, copper, silver, platinum for the β radiation follows the same order as their atomic weights. Platinum has an opacity 16 times as great as aluminum. The α radiation from uranium and its compounds is rapidly absorbed in its passage through gases. The absorption for hydrogen, air and carbonic acid was determined, and was found to be least in hydrogen and greatest in carbonic acid. The results obtained on the variation of leakage with distance may be simply interpreted on the theory of ionization of the gas through which the radiation passes. The absorption of the β radiation is comparatively slight. The absorption of the α radiation increases with increase of pressure and very approximately varies directly as the pressure. In one experiment it was found that the rate of leakage between two plates reached a maximum when the gas was at a pressure of less than half an atmosphere and then decreased; at 10-centimetre pressure the rate of leakage was still greater than at atmospheric pressure. The rate of leakage increases at first with diminution of pressure. There appears to be approximately the same amount of ionization in all gases for the same absorption of energy. On comparing the velocities of the ions under similar conditions, in Roentgen and uranium conduction, it appears that the ions in the two types of conduction are the same.

The cause of the radiation continuously emitted by uranium and its salts remains unknown. The results hitherto obtained point to the conclusion that uranium gives out types of radiation which, as regards their effect on gases, are similar to Roentgen rays and the secondary radiation emitted by metals when Roentgen rays fall upon them. J. J. Thomson has suggested that the regrouping of the constituents of the atom may give rise to electrical effects such as are produced in the ionization of a gas. The energy spent in producing uranium radiation is probably extremely small, so that the radiation could continue for long intervals of time without much diminution of the internal energy of the uranium.

A Great Water-Power Electric Plant at Sault Ste. Marie, Mich.

The Michigan Lake Superior Power Company has projected and is now constructing at Sault Ste. Marie, Mich., the works required for the development of power from the falls of the St. Mary's River at this point and the waters of Lake Superior.

The difference in the mean elevation between the water surface above and below the falls is about 19 feet, and the mean discharge over the outflow section at the falls about 70,000 cubic feet per second. The extent of this development is planned to be such that 40,000 horse-power of electrical energy will be realized, the available effective head being accepted at 16 feet and the volume of water required at 31,250 cubic feet per second. The works now being constructed for this development consists of the intake, the canal, the forebay and the power-house, all of which are designed, as to dimensions, to conform to the hydraulic conditions required by the general result to be secured.

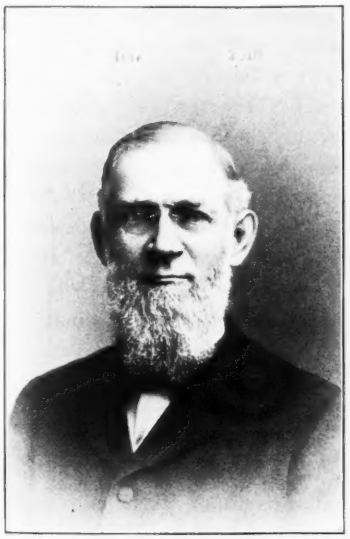
The basis from which the hydraulic conditions have been evolved is the realization of 40,000 horse-power of electrical energy, to be available at any point within three miles from the power-house for manufacturing purposes. The origin of this energy is to be from single-phase, low-voltage electric generators, coupled directly to the horizontal shafts of turbines, which latter are conditioned to develop 45,243 mechanical horse-power, thus providing for the losses entailed during the converting, transforming, transmitting and retransforming of the energy; or 45,243 mechanical horse-power, converted with seven per cent loss, will net 42,077 low-voltage electrical horse-power, which, transformed with one per cent loss, will net 41,655 high-voltage electrical horse-power, which, transmitted with three per cent loss, will net 40,405 high-voltage electrical horse-power, which, retransformed with one per cent loss, will net 40,000 effective electrical horse-power.

The turbines are to develop a mean efficiency of 80 per cent for a range of three-fourths to full gate opening, and the development of 45,243 mechanical horse-power on the shaft therefore requires a gross hydraulic power of 56,554 horse-power.

President Hudson, of the American Bell Telephone Company, is expected to sail for Europe this week, to be absent a month.

New Officials of the Sprague Electric Company.

Portraits of Mr. John E. Searles and Mr. Henry Hine, vice-president and general manager of the Sprague Electric Company, respectively, are presented on this page. Mr. Searles, who is a widely known financier and a



MR. JOHN E. SEARLES, VICE-PRESIDENT OF THE SPRAGUE ELECTRIC COMPANY, OF NEW YORK CITY.

gentleman of force and enterprise, will assume active duties as the head of the company. Mr. Searles has for several years been interested in the company, but only since Vice president Johnson's retirement a few weeks ago has he assumed official responsibilities, and the vast field of electrical manufacture will now engage his earnest attention.

Mr. Hine is widely known to the electrical field, and was for several years with the United States Electric Light Company, one of the pioneer manufacturers. His success in organizing and managing the Stanley Electric Manufacturing Company, of Pittsfield, Mass., was mentioned last week. Mr. Hine will continue as general manager of the Pittsfield company, but will spend most of his time in New York city. Lieutenant Sprague and Mr. Lundell will both continue with the Sprague company to look after the technical work.

Another Automobile Manufacturing Company.

Pittsburgh and Allegheny capitalists, with $1,000,000 capital stock, last week received a charter at Dover, Del., for manufacturing and selling automobiles in the name of the U. S. Motor Company. The company will also make electromobiles.

AUTOMOBILES IN EUROPE.

IMPRESSIONS OF AN AMERICAN ELECTRICAL ENGINEER.

After a visit of several months in various European capitals, Mr. M. K. Eyre, of Duncan & Eyre, has returned to New York, and in an interview gave his impressions concerning the state of the automobile art in Europe to a member of the ELECTRICAL REVIEW staff.

"There seems to be an erroneous impression," he said, "concerning the widespread use of electromobiles abroad. Probably 400 or 500 at most are in use in Europe. There are a great number of gasoline and petroleum motor vehicles to be seen on the streets in Paris, but the number of electrical vehicles is surprisingly small. I think that gasoline automobiles will never attain a permanent success—at least that they will never be used to any great extent in cities. All efforts so far to do away with the objectionable odors caused by these machines have failed, and their progress through a town is marked by a trail of malodorous vapor which is excessively disagreeable. Great numbers of such vehicles would, especially on a close, hot day, cause a most undesirable condition of things in the narrow and crowded streets of a city like New York."

Referring to the condition of certain of the larger cities, especially

MR. HENRY HINE, GENERAL MANAGER OF THE SPRAGUE ELECTRIC COMPANY, OF NEW YORK CITY.

London, Mr. Eyre said that the congestion of travel in the principal thoroughfares was greater than that encountered in American cities, and constantly growing. On the Strand and other streets in London blockades lasting 20 minutes are of frequent occurrence. The electromobile being shorter than the horse and vehicle now in use, and considerably more manageable, would greatly diminish the tendency to blocking, and free the streets of the unnecessary and undesirable occupancy of the horse.

Speaking of numerous associations which have been formed throughout Europe to foster automobilism, Mr. Eyre said that the suggestion contained in recent numbers of the ELECTRICAL REVIEW for the formation of a national automobile association was one that met with his entire approval, especially in view of the good results which had been obtained by similar organizations in European countries. The Automobile Club de France has wielded great influence in that country for the passage of proper legislature and the definition of the position of automobilists, and has become also a powerful social and even political organization. In England a similar association, after a hard fight, secured the repeal of a law (which was passed when the only self-moving vehicles found upon ordinary roads were road-rollers and traction engines), requiring all self-propelled vehicles to be preceded by a man with a red flag, and to move at not more than four miles per hour. He spoke of the magnificent roads in France and of the fine English highways, and described a trip on an American built electromobile, using an English battery, from London to Brighton. On this trip of 53 miles an average speed of over 20 miles per hour was maintained, and the trip was made on one charge of the battery. At times bursts of speed up to 35 miles per hour were made, the effect being a little alarming to one unaccustomed to travel over roads at railway velocity. Mr. Eyre thought that the future of automobiles was no less important than that of the electric street railway, and that there may be expected in this line some such development as had marked the electric light and the electric street railway. He is convinced that vast sums of money will be invested in the new industry of automobile building, and has faith that the electromobile will be developed to such a point that it will be the only vehicle in considerable use in cities five years from now.

No Public Electromobiles in London?

It is reported from London that the Electric Cab Company has dismissed its employés and closed its plant, chiefly in consequence of the difficulty it has had in finding drivers for the vehicles.

Electrical Review

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News, Subscriptions and Advertisements.

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week, although it is occasionally possible to get in matter received on Monday.

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THE ELECTRIC RAILWAY AND REAL ESTATE IN NEW YORK CITY.

During the old horse-car days on the Boulevard (now Broadway) in New York city, the erection of a new apartment building on the stretch between Seventy second and One Hundred and Tenth streets was infrequent and attended with more than the usual risk likely to be taken by a builder or a real estate operator. When such buildings were put up, the owner limited the cost of construction, in order to lessen the amount of capital involved in the venture. The result was that one of the most beautiful avenues in the city, with a tree-covered, grass-bordered walk down its center, and asphalt driveways on either side, was disfigured by long intervals of board fence, covered with glaring advertisements, and enclosing vacant property.

The principal cause for this condition, which hindered the natural development of the Boulevard as a residence thoroughfare, was the lack of rapid-transit facilities. Only those who had to would ride on the ramshackle Boulevard horse cars. The nearest elevated stations were two long blocks to the eastward, between Seventy-second and One Hundred and Fourth streets, and from one to six blocks further distant in a direction parallel to the Boulevard. North of One Hundred and Fourth street, excepting the horse cars, the nearest approach to the elevated railways was by the One Hundred and Twenty-fifth street crosstown line. Naturally, when a man could secure a living apartment in another and more easily accessible quarter of the city he did so, even at a slightly higher rental. Comparatively few people resided on the Boulevard; primarily, because there were few apartments to be had and, secondarily, because of the reasons just noted.

About six months ago, when it became evident that the Third Avenue Railroad Company would substitute the underground trolley system for horse cars on the Boulevard, real estate people waked up, property values increased and building operations at once commenced. To-day, although it is probable that the electric cars will not be running before September 1, there is scarcely an available block on the Boulevard on which one or more buildings are not in course of erection. These new buildings range in cost from $50,000 to $300,000, and compare in merit with any others in New York city. The ultimate and logical purpose of the Boulevard is being rapidly accomplished. With a swift and almost noiseless system of transit throughout its length, giving connections with practically the whole street-railway system of the city, the natural advantages of the Boulevard now loom up, and it is predicted that within a very short time it will become one of the choicest and most desirable residence avenues in Greater New York—for all of which the electric railway may be thanked.

ELECTRIC FERRYBOATS.

It is stated that electrically propelled ferryboats will soon be put in operation across the Delaware River, between Philadelphia and Camden, N. J. The most remarkable feature in this connection is that such boats have not been used before. The steam ferryboat is generally worked under conditions that make it almost impossible to show high efficiency, especially when the course of the boat is short. The fires must burn while the boat is standing at either end of its journey and while it is making half speed. It must be provided with engine and boiler capacity for its highest speed, and these can only be used a part of the time.

With an electrical equipment, the charging may be done while the boat is in its slip at the end of each trip. Batteries worked near their full-charge limit are highly efficient, and such boats may be expected to show a considerable saving in coal, but this is by no means all that will be gained by displacing their steam machinery with accumulators and motors. All space on the main and upper decks required for working-beams, smoke-stacks, etc., will be saved, attendance will be lessened, vibration diminished, and the control-gear put in the pilot-house, so that the steersman may also operate the motors. In this way the boat will be under perfect control, without the possibility of a misunderstanding in signals between pilot and engineman.

RECKLESS ELECTROMOBILE DRIVING.

It has been reported in the newspapers that Mr. W. K. Vanderbilt, Jr., recklessly steering an electromobile down a steep gradient, did something to the controlling gear of the machine, to which it exhibited immediate and violent objection by turning a somersault, throwing out the rider and trying to jump upon him with all four wheels. This performance was suicidal for the electromobile, which broke its back, spilled its battery and otherwise put itself out of the running. Fortunately, the rider escaped without serious injury. What happened was, doubtless, that the machine was reversed while going down-hill at full speed, causing it to throw a somersault. The accident teaches the supreme importance of care and understanding in the handling of the electromobile. One can not throw the reins upon its back and let it jog along home; it will not, of its own volition, turn out to avoid another vehicle. Furthermore, it must not be allowed to run away down hills or compelled to turn corners at too high a speed. To sum it up, it takes nearly half as much experience to steer an electromobile as to drive a horse.

The loss, at one calamitous stroke, of the whole handiwork of Volta in the very act of the celebration of his centenary is a unique tragedy. In the interest of scientific history the preservation of the tools with which great results have been wrought is most desirable. Their presence engenders a form of reverence for the great men of science who have used them for the advancement of mankind, and this reverence is entirely proper. The destruction of Volta's experimental apparatus is not for Italian electricians alone to bear, but is a loss to be deplored by the profession in all parts of the world and for all time to come.

MUNICIPAL LIGHTING IN DETROIT.

"COST WAS A SECONDARY CONSIDERATION."

To the Editor of Electrical Review:

I have the Electrical Review of July 12, and have carefully read Mr. Samuel Insull's article and your editorial, headed, "Municipal Madness."

The people of Detroit did not build the plant to please Mr. Insull or the Review, nor to demonstrate to the world whether lighting by municipalities was advisable or a thing to be avoided. The question of cost was a secondary consideration. Two private lighting companies had furnished light to the city; neither of them satisfactorily. The last company did its work so badly that the city, disgusted with the service, decided to light itself. We are perfectly satisfied with the result.

It is easy to put a lot of figures together, as Mr. Insull has, and show that the lighting costs a great deal more than it really does. I am not now a member of the Public Lighting Commission or I would give you figures to show that Mr. Insull's conclusions are unquestionably wrong, but I trust Mr. Starring, who has doubtless seen the articles referred to, will reply to them in such a way and with such carefully prepared figures that it will convince any one of the incorrectness of Mr. Insull's conclusions.

Mr. Insull's statement that the Commission has "pinched its saving out of its employés heartlessly," is absolutely untrue. You seem to take this view of it in your editorial article, for you say, "purely political considerations prevent the municipal plant from going into the market for labor and making the best bargain for service. It is generally demanded that public servants be well paid." Neither you nor Mr. Insull seem to understand that Detroit did not install its lighting plant simply for the sake of saving money, but that what we wanted most was good service. Our lighting now is first-class. The plant is a magnificent one. Everything is kept up in excellent shape, and Detroit is more than satisfied with the result.

J. L. Hudson.

Detroit, Mich., July 17.

[By his own admission Mr. Hudson substantiates the major proposition of Mr. Insull's article—that electric light costs more than it ought in Detroit; it is fairly evident that the cost to taxpayers is not given over-anxious consideration there.

Mr. Insull's paper was about cost of light; the editorial article was a showing of the folly of municipal operation of public-service installations, the Detroit lighting system being a peculiarly conspicuous example.—Editor Electrical Review.]

Sparking Plugs for Gas Engines.

To the Editor of Electrical Review:

We notice, in your issue of July 19, a request for the address of manufacturers or of dealers in sparking plugs for gas engines. We are pleased to call your attention to the fact that we have been manufacturing, for some years past, a plug or point for this service, possessing superior merits, and which is in extensive use by the principle gas engine manufacturers of this country to-day. Any communications, addressed by your correspondents to us, will receive prompt attention.

Baker & Company.

Newark, N. J., July 21.

An Interrupted Electrolytic Interrupter.

To the Editor of Electrical Review:

Allow me to send for publication in your journal the following memorandum in regard to a method of making practicable an electrolytic interrupter for X-ray work:

An obstacle to the use of the electrolytic interrupter for X-ray work, in the form described by Wehnelt, is the stopping of the current after a short time; often the interrupter will work for a minute or two only or even less. To overcome this difficulty and to reduce the number of interruptions per minute, I have put in the circuit with the interrupter a commutator, the speed of which can be readily varied. If the commutator makes about 2,500 breaks per minute, for example, the electrolytic interrupter runs without stopping, and the light in the Crookes tube is steady.

Francis H. Williams, M. D.

Boston, July 20.

Lieutenant Eames's Views on an Automobile Association.

To the Editor of Electrical Review:

After a short absence from the office we find awaiting us your esteemed communication of July 14, suggesting an automobile convention.

While the suggestion is in itself an excellent one, we are inclined to believe that the time is not yet ripe for an automobile club along the lines suggested by you. It seems to us that the speculative nature of many of the automobile enterprises now in existence would be likely to introduce elements of self-interest and self-advertising into the organization, which would interfere materially with the object in view.

We are heartily in sympathy with any and every attempt to encourage the formation of automobile clubs of a purely social nature, and believe that the present time is ripe for this sort of thing. While an automobile association formed immediately might and probably would in some form survive what we believe would be the inevitable early dissensions, the chances that such an organization would occupy a commanding place among those interested in the art, would be greatly enhanced by postponing the organization until the trade had become generally more stable.

However, it is a source of great gratification to us to know that a journal of your prominence and position takes so strong an interest in this matter, and we shall look forward with considerable interest to the results of your suggestion.

Columbia and Electric Vehicle Company,

H. H. Eames.

Hartford, Ct., July 18.

PERSONAL.

Mr. J. H. Reid, of Pittsburgh, who is well known in electrical circles all over the country, visited New York city last week.

Mr. Marcus Daly, the copper king of Montana, is said to be the anonymous donor of $10,000 to the University of Chicago, announced recently.

Mr. Thomas G. Grier, of the Western Electric Company, Chicago, and author of a "Note Book of Wiring Tables," was among the out-of-town visitors to New York city last week.

The Albert Medal of the Society of Arts has been awarded to Sir William Crookes, F. R. S., "for his extensive and laborious researches in chemistry and in physics, researches which have, in many instances, developed into useful and practical applications in the arts and manufactures."

OBITUARY.

Charles F. Perry, superintendent of contracts for the Edison Electric Illuminating Company of Brooklyn, N. Y., fell dead on July 18 at his home in Brooklyn. He was one of the leading members of the Masonic order in Brooklyn.

The Tramways and Light Railways Association in England.

The Tramways and Light Railways Association has been organized in London to represent the industries named, along lines similar to those in which the American Street Railway Association has been so successful. The body will be governed by a president, vice-president, and a council of not more than 18 members. Messrs. George Richardson, George F. Fry, Emile Garcke, J. Barber Glenn, W. M. Murphy and Stephen Sellon, all prominent electric railway men, have been nominated as the first members of the council. Mr. A. M. Wilcox, editor of *The Railway World*, has been appointed honorary secretary, and his journal will be the official organ of the association. The first election of members will be held before August 1.

National Association of Municipal Electricians.

The preliminary arrangements are about completed for the fourth annual convention of the National Association of Municipal Electricians, which will be held at Wilmington, Del., September 5, 6 and 7, 1899. All the space has been taken in the electrical exhibition which will be held in connection with the convention. Favorable rates have been secured from the principal railroads. The Board of Trade of Wilmington has taken charge of the entertainment features of the meeting.

New Niagara Suspension Bridge Opened.

The new suspension bridge at Niagara Falls, connecting Lewiston Mountain with Queenston Heights, was opened to traffic on July 21 by the International Traction Company. This bridge was illustrated and fully described in the Electrical Review for May 10, 1899.

Western Electric Company's English Plant Burned.

A newspaper cablegram from London, dated July 21, states that the Western Electric Company's cable works at Woolwich, a new plant, had been totally burned out. The loss is estimated at £250,000.

Electric Ferryboats.

Plans are being matured for substituting electricity for steam as the motive power on the ferryboats plying between Philadelphia, Pa., and Camden, N. J.

ELEMENTS OF DESIGN FAVORABLE TO SPEED REGULATION IN PLANTS DRIVEN BY WATER-POWER.*

BY DR. ALLAN V. GARRATT.

In this paper the writer will endeavor to describe those peculiarities of design of plant which have a special bearing on speed regulation, but no attempt will be made to discuss the theory, mechanical construction or merits of the various water-wheel governors on the market.

The engineer is often confronted with the problem of designing a plant upon an undeveloped or partly developed water-power, and the desired end is to come out with a plant of good mechanical and electrical design, and yet have it such that the speed of the electrical apparatus may be maintained within comparatively close limits under any load variations which can possibly occur, and to maintain the speed within very close limits under any working load variations.

The kind of generating apparatus used, and the nature of the load, predetermines the degree of regulation which must be obtained under both accidental and working conditions, but it is quite evident that the tendency in modern plants is in the direction of apparatus which requires closer speed regulation, and more facility in handling the speed than heretofore.

It is quite possible to obtain on the market water-wheel governors which will—provided the design of plant is good—give quite as good a speed regulation as could be obtained if the plant were driven by first-class steam engines.

There is more than one water-driven electric plant in this country where auxiliary steam plants are used, in which the speed is fully as constant while the load is carried by the water-wheels as while it is carried by the steam plant. The plants of the Derby Gas Company, the Pawtucket Electric Company and the Woonsocket Electric Company may be referred to as examples illustrating the above fact.

The largest accidental load variation which can occur is evidently an instantaneous change amounting to the full capacity of the water-wheels. The working load variations may be anything less than this.

The writer has found, in a practice amounting to something over 90,000 horse-power of water-wheels in the last four years, that with good water-wheels properly set and rigged, and controlled by governors of suitable design, the speed may be held within five or six per cent of normal upon circuit-breakers opening under full load, and that the speed may be brought back to normal in from five to 15 seconds, depending upon the amount of kinetic energy in the rotative parts and moving water column. With incandescent loads of the ordinary type, a recording tachometer will show a practically straight line. With ordinary electric railway loads, speed variations of about three per cent as a maximum may be expected. These figures are not intended to be of universal application, but are for simply showing the present state of the art. It should here be added that governors can be obtained which will permit any number of independent water-wheel units driving electrical units connected in parallel to be operated with perfect convenience and safety. It should also be noted that in the case of alternating units it is perfectly easy to get them at speed and in step for multiple connection without undue delay, and without any hand regulation.

These desirable ends can not, however, be obtained to their fullest extent if the general design of the hydraulic portion of the plant is bad. We will now consider those things, aside from the governor itself, which tend to make the regulation good or bad.

As a preliminary thought let us consider for a moment that the problem is quite different from steam engine governing, which naturally comes to the mind in this connection, for the reason that water is heavy, practically non-compressible or non-expansive, and must be transmitted to the water-wheel in large volume and at low velocity; while steam is light, highly compressible and expansive, and may be transmitted to the engine in small volume and at high velocity. From this it follows that the engine valves are small, light and may be perfectly balanced, while water-wheel gates are necessarily large, heavy and are frequently, although often unnecessarily, out of balance. The inertia of the steam may be always neglected; the inertia of the water must be always considered.

The problem of governing a water-wheel, then, involves moving large volumes of a heavy, practically incompressible fluid acted on by the force of gravity alone, and of moving ponderous gates; and this must be done with absolute precision and great promptness. Also adequate provision must be made for the momentum and inertia of the moving water and mechanical parts.

To put our minds in a proper attitude to approach this subject, let us refresh our memories in regard to some of the relations of force, mass, velocity and time.

We have here a mass free to move. Its property of inertia prevents its moving until some force is applied to it. When, however, I apply for a moment the force of my hand it begins to move, and when I stop pushing it, it continues to move with a fixed velocity until I apply to it the same amount of force I used to put it in motion which brings it to a rest, and it can not move again until a new force is applied to it.

I have here a pendulum beating seconds, and here (Fig. 1) are two masses consisting of pairs of balanced weights suspended by fine wires over pulleys which have as little friction as possible. One of these masses is twice as great as the other. If we apply to them equal forces in the shape of small additional weights we will find that at the end of one second the smaller mass has acquired twice the velocity of the larger mass; or, in other words, where forces are equal the rates of acceleration are inversely proportional to the masses.

But now I have here two equal masses (Fig. 2), and if we apply to them two forces—one twice as great as the other—we will observe that at the end of one second, the velocity of the mass acted upon by the larger force is twice as great as that of the mass acted upon by the smaller force; or, in other words, where masses are equal, the velocities are proportional to the forces.

Now, I have here two masses (Fig. 3), one twice as great as the other, and if we apply to the larger mass a force twice as great as that which we apply to the smaller mass, we will observe that at the end of one second, their velocities are the same; or, in other words, for equal velocities, the forces must be proportional to the masses.

Or, to generalize: Velocities are inversely proportional to masses, and directly proportional to forces.

Or, by assuming the unit of force as that force which will, in unit time, give unit mass unit velocity, we may formularize the phenomena we have observed, by writing

$$\text{Force} \times \text{Time} = \text{Mass} \times \text{Velocity} \quad (1)$$

from which we may get by transposition

$$\text{Force} = \frac{\text{Mass} \times \text{Velocity}}{\text{Time}} \quad (2)$$

$$\text{Time} = \frac{\text{Mass} \times \text{Velocity}}{\text{Force}} \quad (3)$$

$$\text{Mass} = \frac{\text{Force} \times \text{Time}}{\text{Velocity}} \quad (4)$$

$$\text{Velocity} = \frac{\text{Force} \times \text{Time}}{\text{Mass}} \quad (5)$$

The product of "force" into "time" is called "impulse," and the product of "mass" into "velocity" is called "momentum"; the equation teaches us that an "impulse" is equal to the "momentum" which it produces.

It is chiefly with the practical laws we have just enunciated that we have to do in regulating the speed of water-wheels.

Let us examine still further into the matter. We know that if we let any weight fall freely under the force of gravity—or, as it is usually written, with a force $= g$—at the end of one second it will have acquired a velocity of approximately 32.2 feet per second; or, if we throw any weight up with an initial velocity of 32.2 feet per second, the force of gravity will stop it in one second.

In the latter case, the velocity at the start=32.2, and the velocity at the end of the second = 0, and the mean or average velocity and the distance it will travel = 32.2 ÷ 2= 16.1 in the first second. Therefore, the work in foot-pounds, which any weight can do by being thrown vertically with an initial velocity of 32.2 feet per second = weight $\times \frac{g}{2}$ feet.

Please note that in the above case, the initial velocity (V) = g or 32.2, and that $V \div g = 1$.

If, however, we have thrown the weight upward with an initial velocity twice as great as before; i. e., 64.4 feet per second, the force of gravity would stop it in two seconds; but the mean velocity in this case is 64.4÷ 2=32.2, which is twice what it was before, and we must also note that it was traveling upward twice as long as it was before; hence by doubling both the velocity and the length of time, it will ascend four times as far. Thus, by doubling its $V \div g$, which in the latter case = 2, we have enabled the weight to do four times the work. Or, we may truthfully state that in the second case the work equals that in the first case multiplied by $(V \div g)^2$; or, formulating it

$$\text{Work in foot-pounds} = \text{weight} \times \frac{g}{2} \times \left(\frac{V}{g}\right)^2 \quad (6)$$

$$\text{Work in foot pounds} = \text{weight} \times \frac{g}{2} \times \frac{V^2}{g^2} \quad (7)$$

$$\text{Work in foot-pounds} = \text{weight} \times \frac{V^2}{2g} \quad (8)$$

or we may more conveniently write it

$$\text{Work in foot-pounds} = \frac{\text{Weight}}{g} \times \frac{V^2}{2} \quad (9)$$

which is the form in which we will have occasion to most often use it.

As this is a universal law, applicable to any force and any velocity, it is applicable to water falling under the influence of gravity.

To fix it in our minds let us apply it numerically to the masses with which we have been experimenting. Start with the masses as shown in Fig. 2.

Let the masses M and M_1 be equal, and let them each be numerically equal to 1. Let $F = 2$ and $F_1 = 4$. Let their time of action $T_2 = 1$ second, then their velocities at the end of the time T will be

$$V = \frac{F\ T}{M} = \frac{2 \times 1}{1} = 2$$

$$V_1 = \frac{F_1 T}{M_1} = \frac{4 \times 1}{1} = 4$$

Now at the end of the time T stop the action of the forces F and F_1 and apply to the masses M and M_1 in an opposite direction a new force $F_2 = 2$. This new force will stop the masses in the following lengths of time:

*A paper presented at the sixteenth general meeting of the American Institute of Electrical Engineers, Boston, June 27, 1899.

$$T_1 = \frac{M \times V}{F_2} = \frac{1 \times 2}{2} = 1$$

$$T_2 = \frac{M_1 \times V_1}{F_2} = \frac{1 \times 4}{2} = 2$$

But the space S_1 and S_2 through which they will travel before they stop will be

$$S_1 = \frac{V T_1}{2} = \frac{2 \times 1}{2} = 1$$

$$S_2 = \frac{V_2 T_2}{2} = \frac{4 \times 2}{2} = 4$$

or the masses are as 1 : 1
and the forces applied to them are as 2 : 4
for lengths of time which are as 1 : 1
which give them velocities which are as 2 : 4
and cause them to travel through spaces which are, during time T, as 1 : 2
consequently doing work on them which are as

$$\left(1 \times \frac{2 \times 2}{2}\right) : \left(1 \times \frac{4 \times 4}{2}\right) \quad 2 : 8$$

They can then oppose equal forces through spaces which are as 1 : 4
during lengths of time which are as 1 : 2
consequently doing amounts of work which are as FS and FS_1 or $(2 \times 1) : (2 \times 4)$ or 2 : 8

In the above case the masses M and M_1 should consist of weights 32 2 pounds; that is, the weight at each end of the wire should be 16.1. The force $F = 2$ pounds, $F_1 = 4$ pounds, $F_2 = 2$ pounds. A pendulum 39.1 inches long from center of weight to point of support will beat near enough seconds for ordinary experimental purposes. A few experiments carefully carried out with the apparatus shown in Figs. 1, 2 and 3 will teach one more about the relations of mass, force, time and velocity than can readily be learned in any other way.

We are now prepared to see the application of the laws, and the formulæ we have written, directly to one of the most important details connected with the installation of water-wheels. This can be best shown by an example.

We have here two water-wheels (Fig. 4) operating under the same head, which we will assume to be nine (9) feet. You will observe that although the head is the same in both cases, one wheel—which we will designate No. 1—is set in an open flume of ample size; while the other wheel—which we will designate as No. 2—is in a closed flume connected to open water by a long closed pipe which is nearly horizontal. The behavior of these two wheels when operating under variable load is entirely different.

Let us assume, for the purposes of argument, that the efficiency of the wheel is the same at all stages of gate, and that the amount of water which passes through the wheel is proportional to the gate opening, and that the power of the wheel is proportional to the amount of water which passes through it under constant pressure. Now, if the wheel is operating at full gate and half the load is suddenly thrown off, and the suitably designed governor attached to the wheel promptly shuts the gates so that only one-half as much water can pass as when the wheel was at full gate, it is evident that the speed will remain comparatively constant.

Let us see if this will be the case with wheel No. 2. If it is operating at full load, and half the load is instantly thrown off, and the governor promptly shuts the gates so that only half as much water can pass, it is evident that the velocity of the water in the closed pipe must be reduced one-half.

If we assume that the water in the pipe weighs 1,000,000 pounds, and has a velocity at full head of four feet per second, its energy (see formula 9) = 1,000,000 ÷ 32.2 × 4² ÷ 2 = 248,440 foot-pounds, and if the water velocity at half load is two feet per second, then its energy = 1,000,000 ÷ 32.2 × 2² ÷ 2 = 62,110 foot-pounds, and the difference between these two amounts of energy, 248,440—62,110 = 186,330 foot-pounds, must be expended upon the water-wheel before the water velocity is reduced to two feet per second.

If it were expended in one second it would = 186,330 ÷ 550 horse-power, but this is a little quicker than we would expect to do in practice. Suppose we slow up the water column in two seconds, then the energy expended = 186,330 ÷ 550 × 2 = 169 horse-power for two seconds. The above value of horse-power would not hold strictly true unless the rate at which the gate closed was proportional to the rate at which the water column slowed up; but the total foot-pounds expended on the wheel would be as above stated. To find the exact value of horse-power at any instant of time, would require a more elaborate mathematical treatment of the problem than the time now at our disposal permits; but the significant fact to which I wish to call your attention is that this work done upon the water-wheel in slowing up the water column, is entirely independent of, and in excess of, the work which is expended upon the water-wheel when it is working normally at half gate, with the water column moving at a fixed velocity.

It is evident that the above amount of work done upon the wheel while the water column is slowing up, would tend to make the speed of the water-wheel run high if the governor only half closed the gates. In fact, the governor would have to set the gates much nearer closed than one-half; or, to speak more accurately, the governor would, at each instant of time, have to hold the gates at such a position that the power developed by the wheel, due to the working head plus the instantaneous value of power being developed by the slowing water column, equaled the load upon the wheel.

This might be found to be quite unfeasible, for the pressure developed on the closed pipe and wheel-case might be dangerous, or the gate might be too ponderous or too badly rigged to permit of the requisite promptness of motion.

The maximum pressure which would be developed at any instant of time at the water-wheel, would be an impossible thing to calculate without knowing a great deal more about the venting areas and time-ratio of closing them than can ordinarily be found out in practice. All that can be predetermined is what may be called, for want of a better term, the time-average pressure. This can easily be determined as follows:

Let P = the time-average pressure.
L = the length of the closed flume in feet.
V = the water velocity in feet per second.
T = the time in seconds in which the water velocity is arrested.
K = the area of a square inch expressed in square feet = .00694.
Then

$$P = \frac{K \times 62.4 \times L \times V}{32.2 \times T} \qquad (10)$$

It will be observed that

$$\frac{K \times 62.4}{32.2} = .01324$$ is a constant, call this K_1 and the formula becomes

$$P = \frac{K_1 \times L \times V}{T} \qquad (11)$$

Applying this to the flume we have been discussing in which

$L = 300$
$V = 2$
$T = 2$

we have $P = \frac{.01324 \times 300 \times 2}{2} = 3.97$

As a water column one foot high exerts a pressure of .43 pound per square inch, it follows that a pressure of 3.97 pounds per square inch represents a head of 3.97 ÷ .43 = 9.2 feet. In other words, if the pressure on the wheel could have been kept constant all the time the water column was slowing up from four feet per second to two feet per second, the wheel would have been working under 9 + 9.2 = 18.2 feet of head, instead of under nine feet of head as it should have been.

From experience we know that it is impossible to close the water-wheel gates at such a rate as to keep the pressure constant, and, as a matter of fact, during some portion of the two seconds the water pressure would have been greatly in excess of 3.97 pounds per square inch above normal, with a correspondingly large disturbance of the speed.

(To be concluded.)

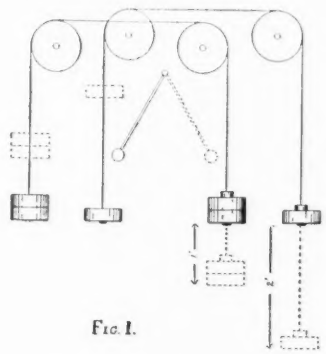


FIG. 1.

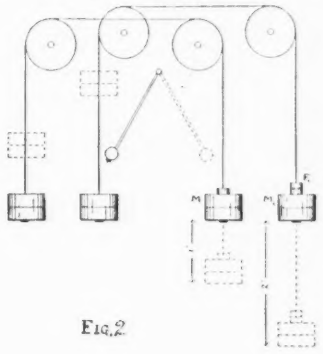


FIG. 2.

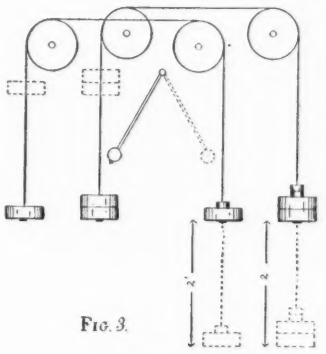


FIG. 3.

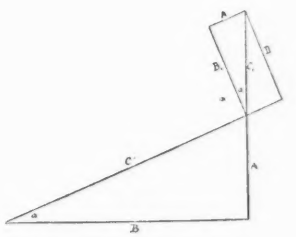


FIG. 5.

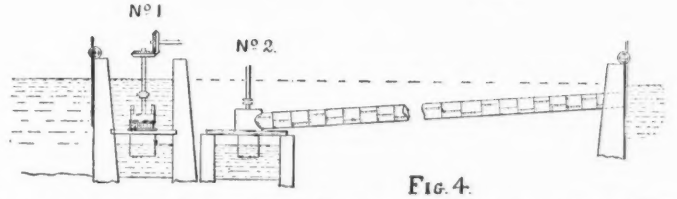


FIG. 4.

FIGS 1-5.—DIAGRAMS ILLUSTRATING "ELEMENTS OF DESIGN FAVORABLE TO SPEED REGULATION IN PLANTS DRIVEN BY WATER-POWER."

Street-Railway Strike in Cleveland.

The dissatisfied employés of the Big Consolidated Street Railway, of Cleveland, Ohio, went on strike on July 19, and since then instances of violence have been frequent. On the night the strike was declared, a car was blown up with dynamite on Prospect street, and a woman passenger was injured seriously. Mobs gathered in various parts of the city, and the riot signal was sent to police headquarters from seven different points. Overhead wires on the Big Consolidated system were pulled down in many instances.

The rioting continuing on July 21, Mayor Farley requested Governor Bushnell for troops, and received instructions to call out all the militia in Cleveland, if required. The naval reserves, three troops of volunteer cavalry, the Cleveland battery and the fifth regiment of infantry were called out on July 22. The military force comprised about 600 men in all.

Threats of personal violence were made against President Everett and other officials of the Big Consolidated road. A number of linemen connected with the United States Telephone Company, in which Mr. Everett is interested, went on a sympathetic strike, and called in gangs of men working in surrounding towns.

On July 22, a Euclid avenue car was blown up with dynamite by the strikers and 18 persons were hurt. The militia made several bayonet charges and numerous persons in the mob were injured. The police also took a hand in dispersing the crowds. The city was in a state of anarchy, and President Everett removed his family to the suburbs for safety. During the night of July 23, the electric light lines were cut by the strikers, and the city was in darkness for half an hour. The fire department was called out to quench fires built by the rioters on the street railway tracks.

The rioting continued in various parts of the city on July 23, and several cars were dynamited by the strikers. A number of passengers were injured by nitro-glycerine and dynamite explosions. A non-union conductor shot and killed a boy who was in a crowd that threw stones. Barricades were built by the strikers on the railway tracks at 50 places in the city. Soldiers were patrolling the streets, but their number was wholly inadequate, and it was expected that more troops would be ordered out. The street-railway company refused to have anything to do with the union, and it was evident that order could only be restored by force. The members of Battery A, with eight Gatling guns, were on duty at important street crossings. The union is extending the linemen's strike to all points touched by the United States Telephone Company.

Failure of the Street-Railway Strikes in Brooklyn and New York City.

As predicted in the ELECTRICAL REVIEW last week, the alleged strike of employés of the Brooklyn, N. Y., Rapid Transit Railroad, which was ordered on July 16, came to an end on July 20, with nothing accomplished except slight damage caused by a few instances of mob violence. An attempt was made to blow up an elevated railroad structure in Brooklyn, but it failed, and the police believe they have the guilty persons under surveillance. Another attempt was made to blow up a trolley car by placing a stick of dynamite on the track, but this was discovered in time to prevent any catastrophe. The quick and efficient work of the police force is largely responsible for the prompt quelling of disorder.

On the morning of July 20 an attempt was made to tie up the electric railways comprised in the system of the Metropolitan Street Railway Company, of New York city. The attempt failed miserably, the only instances of disorder being one or two small outbreaks in the upper part of Second avenue. Less than 120 men of the total number of employés of the Metropolitan company went out, and only a part of these stayed out. From the point of view of the passenger no strike was in evidence, and apparently there were as many cars run as under ordinary circumstances.

Among the thinking men, of whom there are many, employed by both the Brooklyn and New York roads there was no good reason for a strike, which is why the efforts of the Knights of Labor did not succeed.

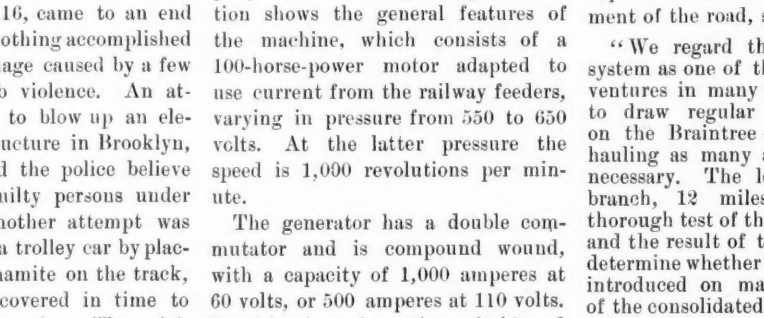
Mr. J. E. Woodbridge, editor of the *American Electrician*, and Miss Ethel Hotchkiss, daughter of Mr. and Mrs. J. F. Hotchkiss, were married on July 23 at Grace Church, New York city.

A Storage-Battery Booster.

There has been shipped recently to the La Capital Company, Buenos Ayres, South America, a booster to be used in connection with the extensive electric system of this company. The accompanying illustration shows the general features of the machine, which consists of a 100-horse-power motor adapted to use current from the railway feeders, varying in pressure from 550 to 650 volts. At the latter pressure the speed is 1,000 revolutions per minute.

The generator has a double commutator and is compound wound, with a capacity of 1,000 amperes at 60 volts, or 500 amperes at 110 volts. Provision is made at the switchboard for using the shunt and series coils separately, the series winding giving a pressure of 60 volts, while the shunt winding produces 110 volts. The machine is equipped with a shaft oscillator which is of the automatic magnetic type. The machines are rigidly connected by a flanged coupling, and are mounted on a heavy iron sub-base, which results in perfect alignment. While under test, in the presence of the purchaser's engineer, this machine, it is stated, was shown to possess a perfect electrical and mechanical balance, and to run cool throughout its several parts.

This is the second booster which the makers, the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, have furnished the La Capital Company. The most reliable machinery must be selected for such a far off installation, as failure so distant from the source of production would be disastrous to the business interests of the operating company.



A STORAGE-BATTERY BOOSTER.

Windsor Castle, one of Queen Victoria's residences, is to be equipped with 50 sets of electric bells and fire-alarm boxes of American manufacture.

Another Third-Rail Line Opened.

The Braintree - Cohasset, Mass., branch of the New York, New Haven & Hartford Railroad began running all its regular trains by the third-rail system on July 24. Col. N. H. Heft, supervisor of the electrical department of the road, said:

"We regard the opening of this system as one of the most important ventures in many years. We intend to draw regular passenger trains on the Braintree - Cohasset branch, hauling as many as 8 or 10 cars, if necessary. The length of the new branch, 12 miles, will furnish a thorough test of the third-rail system, and the result of the experiment will determine whether this system will be introduced on many other branches of the consolidated road."

LITERARY.

The *Street Railway Journal* is now publishing, in addition to its regular monthly issue, a weekly news edition containing a digest of the street railway happenings of the world.

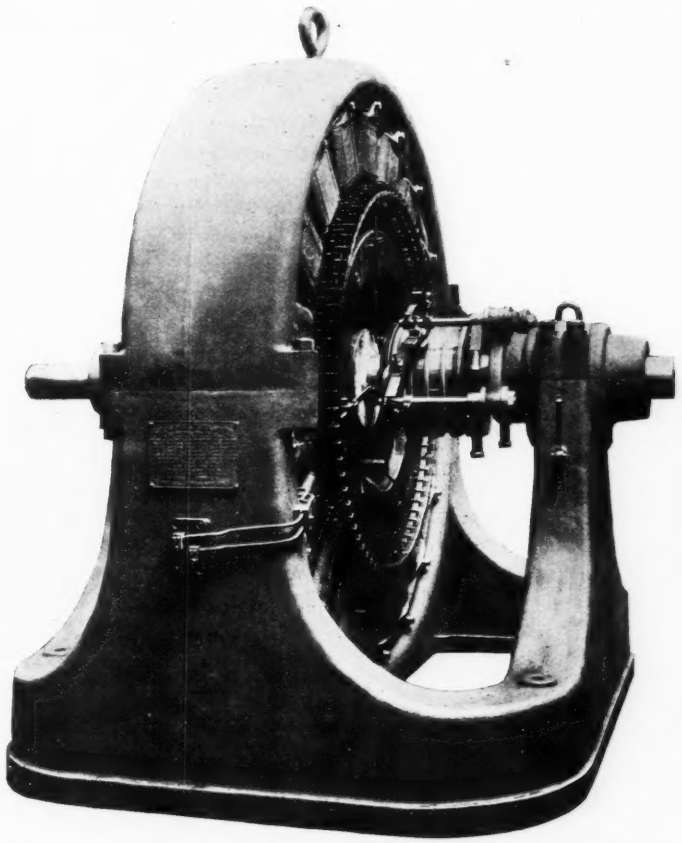
The fiction number of *Scribner's Magazine* has come to be an annual event of importance to writers and readers of short stories. In it, during the past 10 years, have appeared the most notable short stories of writers established in reputation, and writers whose reputations began with their appearance in this issue. The present fiction number (August) is remarkable for its color printing, its brilliant pictures by young artists, and the high excellence of the short stories.

A certificate of the consolidation of the Glens Falls, N. Y., Gas Light Company and the Glens Falls Electric Light and Power Company, under the name of the Glens Falls Gas and Electric Light Company, with a capital of $250,000, has been filed. The directors are F. S. Butterworth, W. F. Peacock and Lewis C. Herckenrath, of New York city.

Irrigation by Electricity.

A more than usually interesting installation has just been completed in California. The Mount Whitney Power Company determined to use nature's power, provided by the Sierras, to supply irrigation to the lowlands surrounding Visalia. The president of the company, Mr. William H. Hammond, secured the necessary capital, and at the end of last year consulted with the Westinghouse Electric and Manufacturing Company, who designed a system to generate electricity in the mountains, and to transmit electric current to the adjoining San Joaquin valley for distribution at several substations, from which it would be further distributed wherever power might be required for pumping and other purposes. The electrical scheme was designed by the company's engineers, and adapted to local requirements. This venture being the first electrical installation applied mainly for irrigation, it has many novel features, and presented many difficulties, which have all been successfully surmounted. The 1,800 horse-power or energy generated at the central station had to be transmitted upwards of 40 miles. As the plant has but recently been inaugurated, it is too early to speak of its success, but there is every reason to suppose that the benefits derived from this system of irrigation, operated by electricity, will lead to further large undertakings of a similar character.

Mr. Hammond contracted for a complete plant for generation and transmission of electrical current. The main generating station is at Mount Whitney. It is equipped with the best and most improved machinery. Power is supplied by water from the east fork of the Kaweah River, diverted at Oak Flat, 45 miles from Visalia, at an altitude of 2,400 feet. A tunnel 47 feet in length runs through solid granite into a pool in the river, so deep that no drift will interfere with the outlet. From this tunnel the water is carried in a flume nearly six miles, the water traveling that distance in one hour and ten minutes; it then enters a pipe-line 3,300 feet long, which makes a descent of 1,300 feet in that distance. The current of water operates Pelton water-wheels, which are direct-connected to three 450-kilowatt Westinghouse alternating-current generators. The illustration shows one of these generators, which are of the revolving armature type, three-phase, 440 volts, running at 514 revolutions per minute. The generators are guaranteed to operate at full load for 24 hours with a temperature not exceeding 40 degrees centigrade above the surrounding air; or at an overload of 25 per cent for 24 hours with a temperature not exceeding 50 degrees centigrade above the surrounding air; or at 50 per cent overload for two hours, temperature not to exceed 60 degrees centigrade above the surrounding air. Two direct-current multipolar generators, each of 15 kilowatts, with electro-motive force 125 volts, are used for exciting the three large generators. These exciters are direct-connected to smaller water-wheels. A very complete switchboard was provided for this station, consisting of three alternating-current generator panels, one exciter panel and one transformer panel. Each generator panel is furnished with voltmeter, ammeter, one integrating wattmeter, three-pole quick-break main switch, rheostat and all modern appliances. The other panels are also fully furnished with modern devices. From the central station at Mount Whitney the current is transmitted to several substations which distribute current over the valley. Conducting lines are led to Visalia, Tulare, Exeter, Lindsay and Porterville. The distance from Mount Whitney to Visalia is 29 miles; to Tulare, 40 miles; Porterville, 43 miles. To transmit the electric current to these distant points the Mount Whitney power-station is equipped with four 500-kilowatt Westinghouse oil-insulated, air-cooled transformers, which raise the current from 440 volts, three phase, to either 17,000 volts, or 34,000 volts, for transmission to the substations. The efficiency of these transformers is guaranteed to be, at full load, 98.4 per cent. Three Wurts non-arcing lightning-arrester coils are provided for the protection of the station, and others for the substations. The Visalia substation is equipped with four 75-kilowatt, oil-insulated, self-cooling Westinghouse transformers, which lower the transmitted current from the transmission circuit to 2,000 volts, together with switchboard, lightning arresters and type "C" line arresters for the distributing lines. The other substations are similarly provided, according to the amount of power required in each. At present Visalia is using 344 horse-power; Tulare, 90 horse-power; Lindsay, 175 horse-power, and Porterville, 90 horse-power. But these quantities will soon be increased for lighting, manufacturing and pumping purposes. The supply of power will be continuous, night and day, and will materially reduce the cost of power and lights. From the various substations current will be distributed at a lower potential, suitable for operating various motors attached to pumps, which draw water from wells for irrigation purposes. A large number of Westinghouse motors, ranging from one-half horse-power to 30 horse-power, have been shipped to this district to be driven by the power from Mount Whitney station. The electric current was conveyed to Visalia, June 29, for the first time, and the city supplied with electric illumination that night. During the last two seasons California has suffered so greatly from the effects of the drought, that the farmers of Tulare County expect that the introduction of electricity will open a new era for them. The uncertainty of the seasons being removed by the assurance of a constant supply of water from wells for irrigating their lands will add greatly to the value of property in that district. A large part of the cultivation of California is dependent upon irrigation, and extensive canals are employed for this purpose. The electric transmission supplements this and will be of great value in many places where it is impracticable to obtain water by other methods and where water happens to be within a short distance of the surface.



"IRRIGATION BY ELECTRICITY"—WESTINGHOUSE 450-KILOWATT, THREE-PHASE GENERATOR AT THE MOUNT WHITNEY POWER COMPANY'S PLANT.

DIVIDENDS.

The directors of Twin City Rapid Transit Company, of St. Paul, Minn., have declared a dividend of one per cent on the common stock, payable August 15. Books close August 11.

The Albany, N. Y., Railroad Company has declared its regular quarterly dividend of one and one-half per cent and its usual extra dividend of one per cent. Both dividends are payable August 1 to stockholders of record July 21.

The directors of the Edison Electric Illuminating Company of Boston have declared the usual quarterly dividend of two per cent, payable August 1 to stock of record July 20. Books closed on July 20 and will reopen August 2.

ELECTRIC RAILWAY NOTES.

It is stated that the employés of the Boston Elevated Railway Company are paid higher wages than on any other street-railway line in the world.

The Twin City Electric Railway Company's car barns at St. Paul, Minn., were burned at midnight on July 18, and 60 cars were destroyed. The loss is $125,000.

The New Bedford, Middleborough & Brockton, Mass., Street Railway has been granted an extension of its franchise, allowing the road to extend its lines into Taunton.

New York and Boston capitalists are said to be interested in a project to construct an electric road through the northern section of Frederick County, Md., to Gettysburg, Pa. The road will be 22 miles long.

A decree has been handed down in the Circuit Court at Fort Wayne, Ind., for sale of the Fort Wayne Consolidated Street Railway, to satisfy a mortgage for $724,629 held by the Guaranty Company, of New York city.

Orders have been given by Metropolitan Street Railway Company, of New York city, for ironwork for the extension of the Fourth avenue underground trolley line from its present terminus, near Brooklyn Bridge, to the Post Office.

A large force of men are at work laying tracks for a trolley road through Rockaway Park, Long Island, Justice Maddox having vacated the injunction granted last April to the Rockaway Park Improvement Company to prevent construction by the Rockaway Beach Railroad.

The stockholders of Third Avenue Railroad Company, of New York city, have voted to increase the capital stock from $12,000,000 to $40,000,000. Stockholders of the Forty-Second Street, Manhattanville & St. Nicholas Avenue Railroad have voted to increase the capital stock from $2,500,000 to $7,500,000.

The Hanover, Mass., Street Railway Company, the consolidated road embodying the five roads on the south shore in or near Hingham, has organized and elected the following officers and directors: President, A. L. Register; vice-president, Hon. J. J. Whipple; treasurer, Geo. A. W. Dodge; secretary, Gardner F. Welds; directors, Oliver E. Williams, David Pepper, Jr., Clarence Burgen and Herbert Nash. The road proposes to change its name to the South Shore & Boston Street Railway.

The electric conduit construction on the Third Avenue Railroad Company's Boulevard line, in New York city, which was described in last week's ELECTRICAL REVIEW, is proceeding at a rapid rate and it is expected that electric cars will be running over it in a few weeks. This work was wrongly credited to the Metropolitan Street Railway Company, which is understood to have a traffic agreement to use this part of the line.

Wall Street and the Electrical Stock Market.

During the early part of the current week the labor troubles and indication of a monetary stringency in London, influenced the market. In a short time, however, it was understood that the street railway strikes in Brooklyn and New York were certain to fail, and toward the close of the week the market returned to its normal state, with the local outlook substantially brighter. The decision of the Bank of England to retain its rate of discount at 3½ per cent produced a more cheerful state of affairs. The consequence was that a dull declining market gave place to one somewhat more active and which reflected a strong undertone. In the main, developments of the week have been favorable and the outlook is encouraging.

On the New York Stock Exchange General Electric closed the week at 119½ bid and 120 asked, a gain of 1 point for the week.

Metropolitan Street Railway of New York closed at 211¾ bid and 212½ asked, a loss of 10 points for the week. Third Avenue Railroad of New York closed at 190 bid and 195 asked, a gain of 5 points for the week.

On the Boston exchange American Bell Telephone closed at 347 bid and no asked price, a gain of 3 points in the bid price. Erie Telephone closed at 96 bid and 97 asked.

On the Philadelphia exchange Electric Storage Battery common closed at 155 bid and 160 asked, indicating no change for the week. Union Traction closed at 42½ bid and 42⅝ asked, a gain of ⅛ of a point for the week.

On the curb or outside market in New York Electric Vehicle closed at 95 bid and 100 asked, a loss of 3 points for the week. Electric Boat closed at 15 bid and 16 asked, a loss of 1 point for the week.

Wall Street, July 22.

Telephone News .....and Comment

It was reported in New York city last week that the independent telephone combination deal had been closed.

The Independent Telephone Exchange at Traverse City, Mich., was sold on July 18 by the Sheriff to satisfy a $13,000 mortgage. The holder of the mortgage bought in the property at $10,000. The original cost is said to have been $20,000.

Albert G. Wheeler, of the Illinois Telephone and Telegraph Company, Chicago, is preparing the prospectus of his company and making plans for financing it. The plans of the new company are closely guarded, but it is believed that the owners of the telephone franchise intend to start with a capitalization of $5,000,000 four and one-half per cent 10 to 20-year gold bonds and $5,000,000 of capital stock. At the outset it is understood only half the issues will be offered for subscription. With the money thus to be realized it is proposed to construct three main conduit trunks, radiating north, south and west from the business center of the city. At the limits fixed by the ordinance the wires will be brought up and continued on poles. The company hopes to progress far enough to have 4,500 instruments in service before the beginning of next year. The service will be gratuitous under the term of the contract by which the Illinois company acquired the right to use the Strowger automatic system, until such time as the subscribers number 10,000. Then a straight rate of $72 a year will be announced.

The Missouri & Kansas Telephone Company will hold a meeting at Kansas City, Mo., on September 12, to vote upon the question of increasing the capital stock from $1,250,000 to $2,500,000. The company announces that the general improvement in business has created a demand for increased telephone facilities and superior service, which necessitates the construction of additional toll lines and additional circuits on existing toll lines, the building of additional exchanges, the installation of improved switchboards and the placing of wires under ground in the Kansas City, St. Joseph and other larger exchanges. Congress at its last session granted the company the right to construct toll lines throughout certain desirable portions of the Indian Territory. It is the intention of the company to expedite these improvements so as to meet the demands of the public, and, by a system of toll lines and exchanges connecting all of the cities, towns and villages in the states of Missouri and Kansas and in Oklahoma, make its system so extensive and complete that the use of toll lines will become as frequent for business transactions as is now the use of exchanges in cities. The company has already constructed an extensive underground conduit system in Kansas City and in St. Joseph, and within the past year has and is now making extensions to these underground systems. The toll-line work this year will embrace upwards of 1,000 miles of new toll pole lines, on which is being strung fully 5,000 miles of wire.

Excelsior Electric Company in a Receiver's Hands.

Mr. Charles E. Dustin has been appointed temporary receiver for the Excelsior Electric Company, of 115 Broadway, New York city, in proceedings for the voluntary dissolution of the corporation. It is stated that the company has no available funds to pay its debts or carry on the business. The total liabilities are $230,621. The assets consist of machines, tools, patterns, materials, etc., $46,903 nominal value; office furniture and 55 patents, the value of which is not given in the schedules. Most of the machines, tools and patterns are obsolete. The company was incorporated in August, 1881, with a capital stock of $500,000. In May, 1898, it passed into the control of the General Electric Company. Mr. Dustin accepted the position of president and treasurer. There are 36 stockholders, the largest being C. T. Hughes, $384,500, and J. N. Smith, Lynn, Mass., $35,300. Bonds for $166,000 were issued on December 31, 1888, secured by a mortgage on its plant and other assets. The receiver is authorized to continue the business and to work up the materials on hand at the factory, but it is probable that Mr. Dustin, who was for several years general manager of the Schuyler Electric Company, and is a gentleman experienced in the electrical field, will decide to sell out the stock and wind up the affairs of the company—and thus will disappear one of the first manufacturing concerns of this field.

The School Journal, of New York city, celebrated its anniversary in a creditable special issue under date of June 24.

EUROPEAN ELECTRICAL NEWS.

THE BRUSSELS ELECTRICAL EXHIBITION—RUBBER TREES IN MADAGASCAR—NEW BELGIAN ELECTRIC RAILWAY—A SWISS TUNNEL SCHEME.

The International Exhibition of Electrical Appliances, which has been recently held at Brussels under the auspices of the Belgian Electrical Society, has proved interesting from many points of view. This exposition is a novel one, as it is especially intended to show the progress made in apparatus for domestic and office use, including arc and incandescent lamps, primary batteries, telephones, accumulators, etc.

The exhibition was held in the new Central Telephone Building, which has been recently finished. This is a handsome structure, measuring 60 by 180 feet, and will contain the central telephone exchange of the city, having a capacity of 13,000 to 15,000 subscribers. The Belgian exhibits were naturally the most numerous, and included telephones, accumulators, galvanoplastic processes, cables and glassware. The Belgian State Telegraph Administration showed a fine collection of telephones of the latest pattern, whose construction and working are not surpassed by any now in use. An interesting exhibit was that of the Société des Telephones, which included a series of office and house telephones and ingenious appliances of the same nature, showing the latest improvements in the systems adapted for domestic use, and for hotels and factories. A perfected system of telephone cabinets was shown by the companies Ballet, Davin-Glibert, etc. Among the foreign telephone companies having factories in Belgium were represented the Bell Telephone Manufacturing Company and the Antwerp Telephone Works. The fine galvanoplastic reproductions of M. Menessier attracted considerable attention, as well as his luminous signs and other advertising apparatus. In the line of galvanoplastic work, the Graner Company showed a model workshop in operation. The accumulators, being one of the Belgian specialties, were well represented; the principal exhibitors being the companies Tudor, L'Etincelle and Corbeau; the exhibits included not only the improved types for light and power use, but also special models for use in electromobiles, these having cells in ebonite or like material. The cells made by the Colonial Rubber Company, of Ghent, and Franz Clouth, of Cologne, are among the best of these. The same companies also exhibit a series of articles in caoutchouc and in hard rubber for different electrical purposes.

Among the remarkable exhibits was that of the French glass and chemical works of St. Gobain. Their cells of moulded glass are a new idea in this line, and are certain to come into more general use, as they have the advantages of non-leakage, cleanliness, transparence, etc. There are also grooved pieces, which serve to keep the battery plates apart, and triangular pieces for supporting them on the bottom of the cells. These, as well as the oil insulators and glass insulating supports for dynamo frames, show the application of moulded glass in electrical work. The exhibit includes a large panel of "opaline," a kind of glass which may advantageously replace slate and marble for switchboards, on account of its high insulation, cleanliness, and the fact that it may be obtained in any dimensions required; its whiteness also gives it a decorative effect. This material has been adopted by the Northern Railway Company in its large switchboards and has proved satisfactory. When moulded, this material forms bases for switches and other apparatus, which are much to be recommended. The glass works of the Val St. Lambert show improved designs in globes for arc and incandescent lamps, and ornamental fixtures, chandeliers, brackets, etc., were shown by the Compagnie des Bronzes, Otto Schlee, Joos et Cie, etc.

Among the cables and wires were those of Felten & Guilleaume and Hen et Cie, who exhibited bare and covered cables, systems of wiring, junction boxes and insulated wire of various kinds. The German houses were well represented by Siemens & Halske, who had a large exhibit of various apparatus, and the Allgemeine Electricitäts Gesellschaft, with devices for heating, ventilation and other domestic appliances. Among the measuring instruments were those of Hartmann & Braun and the French house, J. Richard, whose registering voltmeters and ammeters are in general use on the Continent. A number of arc lamps were shown, among which were those of the Hegner Company; most of these were connected three in series on 110-volt circuits. The small arc lamps of Hansen & Company are remarkable for their steadiness of light. Incandescent lamps of different makes were naturally a prominent feature of the exhibition; one Belgian company has a miniature lamp factory, by which the merits of their process are shown to visitors.

This exhibition, which is the first of its kind, has been a decided success, and it is expected that its example will be followed in other countries.

At a recent meeting of the Académie des Sciences, M. H. Junnelle gave an account of a variety of the rubber tree found in Madagascar, called by the natives the Guidroa, which promises to be one of the richest of that country. In fact, the island is well supplied with different varieties of this valuable tree, and the production of rubber on a commercial scale is now beginning to receive attention. Several companies have been formed in Paris for this purpose, as the different products of the island have now become better known. M. Junnelle brings out the fact that the Guidroa is one of the varieties most exploited in the western part of the island, in the districts of Boneni and Menabe. The Sackalaves collect the rubber by making numerous incisions in the trunk of the tree during the dry season, when the sap is very thick. This coagulates almost immediately below the incision, forming a layer of gum, which is taken off an hour later and pressed together into balls; one man can thus collect over two pounds per day. The rubber obtained in this manner is of good quality, and the samples seen by M. Junnelle are very elastic and resistant, possessing but little viscosity. It is estimated that one litre of sap of the rubber tree will produce an average of 415 grammes of native gum. In the wild state, the Guidroa is found in woods whose soil is dry and rocky. M. de Bathie has found it at Andaribe, the valley of Betsiboka, etc. The collecting of rubber from these trees is expected before long to assume important proportions, and in the future the island of Madagascar may be expected to furnish a considerable addition to the existing rubber supply.

A new electric railroad is now being constructed in Belgium, which will be the first road in that country to be operated by electric locomotives. It is of interest from the fact that it will be an application of electric traction to the government railways. The section now in construction has a length of but 12 kilometres, but it is expected that this will be extended when the successful operation of the branch is assured. The work of installing the road is now being rapidly carried forward, as it is desired that it should be finished by the end of the year. The electrical part of the plant is to be furnished by the house of Dulair de Charleroi. The line starts from the town of Mons, and takes in several villages, the number of inhabitants in the district being estimated at 70,000. A single track will be used at first, and the current will be taken by a trolley; the posts for the overhead wire are about six metres high. The trains will consist of a motor car and two passenger cars. The generating station is already completed, and it is expected that the road will be in running order by the first of the year.

A new electric railroad is to be installed in Switzerland, between the towns of Sierre and Zinal, and to this end a company has been formed which has applied for a concession. The road will be 24 kilometres long, passing up the valley of the Anniviers de Sierre to the foot of the glacier of Durhand, crossing the Rhone and passing through several villages on its way. It will be of one metre gauge, with maximum grades of seven and one-half per cent and curves of 30 metres radius. The current for the road will be furnished by a plant which is in construction at Saint Jean; the water-power of the Navizence will be utilized to drive the turbines. The cost of the construction of the road is estimated at 2,200,000 francs. An inclined plane will connect with the line at Vissaye, which will have a length of 900 metres and a slope of 48 per cent, mounting to the village of Saint Luc.

Another Swiss project is that proposed by a prominent engineer at Zurich; his plan is to pierce the mountain of the Zurichberg by a tunnel, through which an electric road will pass to the other side, thus giving communication with desirable land which could not be conveniently reached by other means. Thus the workmen of the town may secure building sites at reasonable rates. The expense of construction of the tunnel would necessarily be great, but the project is one that may be realized both from a technical and a financial point of view. F. P. M.

Paris, July 15.

Mr. W. C. Knight, the Michigan salesman of the Fort Wayne Electric Works, now has his headquarters at Fort Wayne, Ind.

OPERATING COSTS OF HORSE AND ELECTRIC DELIVERY WAGONS IN NEW YORK CITY.*

BY G. F. SEVER AND R. A. FLIESS.

(Concluded from page 47.)

To determine as accurately as possible the lowest value for the power consumption at the different speeds, some special tests were made. A block paved with asphalt which was fairly level between Twenty-fourth and Twenty-fifth streets, on Madison avenue, was selected for the tests. The method of procedure was as follows: First, readings were taken while the vehicle was passing between Twenty-fourth and Twenty-fifth streets and then readings were taken when passing back over the same ground, in every case care being taken that the vehicle had reached a constant speed an appreciable time before the readings were noted. The average of these readings should, of course, eliminate any slight grades, if present, and the average should give the true power consumption for absolutely level asphalt. The readings obtained for the three different speeds of the wagon were:

	Volts.	Amperes.
No. 3 speed—10.5 miles per hour..	82	22
	82	20
Average	82	21
No. 2 speed—5.4 miles per hour...	42	21
	42	18
Average	42	19.5
No. 1 speed—2 miles per hour.....	21	22
	21	16
Average	21	19

At No. 3 speed the rate of travel was 15.4 feet per second and the rate of work 1,722 watts. Since a watt represents 0.7373 foot-pound per second, the total work required to propel the vehicle at this speed for one second was 1,269.63 foot pounds. This represents a rate of 2.3 horsepower. The draw-bar pull was then 52.44 pounds, or at the rate of 39.26 pounds per ton. At No. 2 speed the draw-bar pull was 36.3 pounds per ton. The value of the draw-bar pull at No. 3 speed is probably very closely approximate to the value that would be shown at all speeds between 5 and 12 miles per hour if a dynamometer was used. From the results recorded in the table we may take 105 watt hours per ton per mile as quite within the reach of actual practice under service conditions to-day. However, a more conservative estimate of 120 watt hours per ton mile as a basis upon which to calculate the operating costs of electric vehicles for delivery service will be assumed. Under ordinary conditions a well designed electric delivery wagon should not consume over 120 watt hours per ton mile. In support of this statement the following data are presented, these results being obtained while testing a small carriage which, owing to a number of circumstances, had failed to come up to the expectations of the designers. This carriage had been sent back to the shop for some alterations, and it was at that time that an opportunity was afforded for making a number of experiments and tests upon it. The point of greatest interest in these tests is the fact that, though working under most unfavorable conditions, the watt hours per ton mile did not reach 120. The weight of this vehicle was 1,200 pounds, over 300 pounds more than the original design called for. With one passenger and the instruments it weighed 1,400 pounds. Its draw-bar pull was found by a dynamometer to be over 42 pounds at 8 miles per hour on level asphalt. This is at the rate of 62 pounds per ton, and is approximately the same as found for ordinary horse delivery wagons on cobble stones. This excessive draw-bar pull was due to poor bearing design. Here is the result of a run of 9.45 miles with this vehicle on New York city streets:

Distance traveled	9.45 miles.
Watt-hour meter record	771.15 watt hours.
Average speed	8.0 miles per hour.
Watt hours per ton mile	116.5

It is interesting to note that, even with this abnormal pull, the watt hours per ton mile were only 116.5.

The test recorded was a fairly severe one so far as hill-climbing and bad roads are concerned. The vehicle on this occasion traveled from Fifty-ninth street up the Boulevard to 137th street and return, taking en route the long hill from 125th street to 137th street on the Boulevard; on the return the hill from 125th street to 117th street was surmounted. The hill, climbing part of the trip was over a very bad macadam road surface. The hill at Ninety-sixth street and the Boulevard was surmounted twice during the trip, and the carriage covered 14 miles

Distance traveled	14 miles.
Time in actual motion	1 hour 47 minutes.
Average speed	7 8 miles per hour.
Total watt hours recorded	1162.29
Watt hours per ton mile	118.57

It is worthy of note that with all the hill-climbing, the bad roads and the large friction loss due to bad design, the watt hours per ton mile only reached 118 57. From the above, 120 watt hours per ton mile would seem to be a conservative estimate for the power consumption of well designed electric-delivery wagons in New York city under ordinary service conditions.

SECTION III—HORSE VERSUS ELECTRIC-DELIVERY SERVICE—A COMPARISON.

In considering the advantages and disadvantages of two radically different systems for the performance of the same work, other things being equal, the cost is the deciding factor. Assuming that all other considerations are equal, it will be shown in this section that the cost of operation, maintenance, etc., of the electric automobile is less than for horses in the light-delivery service of New York city, the horse being considered in the most favorable light.

From the results recorded in Section II we are led to the conclusion that, under highly disadvantageous conditions, the power necessary to propel a vehicle through the streets of New York city from the lower part of the town to points situated on the highest ground, including all grades that may be encountered, will not average more than 120 watt hours per ton mile. That this is a high figure for vehicles of good design and equipment is evident from the results obtained while testing the delivery wagon previously mentioned. The fact that the small carriage never reached 120 watt hours per ton mile, though working under most unfavorable conditions, should lend weight to this conclusion.

Taking 120 watt hours per ton mile as a basis on which to compute the power consumed by an electric-delivery wagon, we will now compare the results obtained in Section I with the results that would be obtained if an electric wagon were substituted.

It was found that the total cost per day for 2 horses, 1 driver and 1 boy, was 428.54 cents. The wagon was to travel 42 miles a day—being an average of 21 miles per day for each horse. The time in motion was assumed to be 6 hours. An electric wagon with an average speed of 9 miles an hour could cover this distance in 4.66 hours, thus saving 1 34 hours—the other conditions remaining the same. The cost per day for the electric, assuming cost of power at 5 cents per kilowatt hour, is given below:

1. Cost of power for 42-mile run, at 5c. per kilowatt hour	71.28c.
Assuming power consumption as 120 watt hours per ton mile.	
Weight of wagon	3,750 lbs.
" " driver	150 "
" " boy	125 "
Average load	500 "
Total weight	4,525 "
	2 263 tons.
Watt hours per car mile, 271.56	
" " " 42 " "	11,405.0=11,405 kilowatt hours.
Taking battery efficiency as 80 per cent	
Total power to be paid for = 14.256 kilowatt hours.	
2. Interest on cost of wagon per day	21.4
Cost of wagon, $2,300, at 6 per cent interest.	
3. Interest on stable rent for one wagon	9.30
4. Driver	171.42
5. Boy	114.28
Total cost per day for 42 miles, 1 wagon, 1 driver and 1 boy	387.77c.

Therefore, cost per pound of delivery is .16158 cent, or .01698 cent less than the figures for the horse. The cost per car mile is 9.232 cents, or .968 cent less than for the horse. Cost per ton mile is 4.08 cents, or 6.12 cents less than for the horse service. If we consider the load only, it costs 9.232 cents per 500 pounds per mile, or at the rate of .018464 cent per pound per mile, or .00194 cent less per pound than for the horse service.

Attention is again called to the conditions under which this comparison is made. The horse is supposed to be able to average 21 miles per day, doing this at the rate of 7 miles per hour, under a draw-bar pull of 50 pounds. In other words, he is doing work at the rate of .89 of a theoretical horse-power for 3 hours per day. The automobile, on the other hand, is to do 42 miles a day at the rate of 9 miles per hour, and the cost of power is assumed to be 5 cents per kilowatt hour. Under these conditions the automobile can do the work of 2 horses in 1.34 hours less time than they can do it with a saving of .01698 cent per pound of goods delivered, or at a saving of 40.752 cents per day on a delivery of 2,400 pounds.

Now, having shown that it is cheaper to use an electric-delivery wagon than the present horse-delivery wagon—even when the supposition is made that the horse is doing much more than he really is—it is proposed to make a comparison between the two systems under conditions which actually exist to-day. It was shown above that the delivery horse does not average 18 miles per day during the year. We will assume, however, that the horse does travel this distance per day. Each wagon will go 36 miles a day under this assumption; hence the total mileage of the wagon for the year will be 11,268 miles. This assumes that on Sundays the wagon does not go out. Then for 52 days a year, at least, the horses have to be fed without any work in return. This, of course, is a condition not met in electric automobile service.

The cost per day for the two horses, wagon, driver, etc., necessary to accomplish 36 miles a day was found to be 428.54 cents. The cost of covering 11,268 miles will then be $1,562.20. Here it must be remembered that 365 days have to be taken. The cost per car mile is then 13.86 cents.

When we come to consider the electric automobile for a year, covering 36 miles a day, its advantages are brought out very clearly. Since the vehicle, owing to the nature of its construction, does not consume any energy when not in motion, it follows that, during the periods of rest, while deliveries are being made and the wagon is being loaded, there is no more expense than that incidental to wear and tear. This, of course, is common in amount to all vehicles of the same class and may be considered the same in each case. That a slight loss does occur when the vehicle is at rest, due to local action, etc., in the batteries, is true, but this loss is considered when the efficiency of the battery is taken at 80 per cent. We may say, then, that the factor most important in determining the expense of operating an electric vehicle is the price that must be paid for the power. This is a very variable factor, indeed, and the price per kilowatt hour will determine in all cases the amount of saving that will be possible through the use of electric automobiles.

A stable taking power from a large central station would, if of average size, add a load which, if properly distributed as it easily could be, might become a considerable factor in straightening out the load curve of the station. If several stables were supplied from the same central station, this load would become a great source of economy to the station, and power could be sold to them at a very low figure. Owing to the regular nature of the work imposed upon the wagons in delivery service it could easily be arranged to have the electric vehicles charged at night after the heavy load is off the station.

* Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, Boston, June 28, 1899.

They might also charge early in the morning and at noon, or at periods that experience would indicate were the most advantageous for the station, the time of deliveries being adjusted to suit the new conditions. In this way a stable should be able to buy power at from 1 to 2 cents per kilowatt hour. As this time has not yet arrived we will install for our purposes a small isolated gas engine plant. A plant of this kind should be able to produce a kilowatt hour at the switchboard for 3 cents. Assume the cost for a kilowatt hour as 3 cents, the power consumed per ton mile as 120 watt hours and the weight as 3,500 pounds for the wagon. Taking the average load as 500 pounds, weight of driver as 150 pounds, and that of boy as 125, the total weight is 4,275 pounds. The cost for the electric vehicle to cover 11,268 miles is given below :

1. Cost of power for 11,268 miles at 3 cents a kilowatt hour, and a consumption of 120 watt hours per ton mile, total weight = 4,275 pounds, = 2,137 tons, watt hours per car mile = 256.44, kilowatt hours per 11,268 miles = 2,889.57, taking efficiency of battery at 80 per cent kilowatt hours to be paid for = 3,621.	$108 35
2. Interest on cost of wagon at 6 per cent for year. Cost of wagon, $2,300.	78 05
3. Interest on stable rent for 1 wagon, for year	34 28
4. Driver	625 68
5. Boy	416 83
Total cost per year	$1,263 15

Then the

	cents.
Cost per car mile	11.21
" " ton mile	5.246
" of power per mile	.961
" " power per ton mile	.45

Hence the saving, considering that the horse-drawn wagon does 36 miles a day six days a week, is 2.65 cents per car mile in favor of the electric vehicle, which means a saving of 95.4 cents per day per wagon.

Owing to the greater speed of the electric vehicle, it takes only four hours to travel 36 miles, as against 5.14 hours for the horse. This is a saving of 1.14 hours per day, or of 356 hours a year.

The figures given above speak for themselves and would appear to be a most effective argument in favor of adopting the electric automobile for delivery service.

SECTION IV.—CONCLUSION.

In light delivery service in large cities, when a number of units are employed by individual firms, the adoption of the automobile would seem to be merely a question of time. For this kind of service it seems pre-eminently the best solution. It is cheaper to operate than horse service, and the mechanical problems have been so far solved as to make the vehicles commercially successful. Though, as stated before, it is not the intention to discuss depreciation, it may be noted that the comparison of the costs of operation as regards food, cost of power, etc., would show a saving in favor of the electric delivery wagon, in one year, of 20 per cent, which, under more favorable conditions as to the price of power, might easily be increased. Assuming, for the moment, that the depreciation in a year is 25 per cent for the electric system, and, under the same service conditions, is only 10 per cent for horse traction, we still have a saving of five per cent in favor of the automobile. The advantages that will arise from the substitution of mechanical propulsion for horse traction on a large scale are so well known and understood that any extended consideration of the subject seems unnecessary. Among the many advantages, however, the following would seem to be the most important:

1. The hygienic condition of large cities will be improved, and the cost of street cleaning will be decreased.

2. The wear and tear on pavements and streets will be reduced, and the use of rubber tires will lessen the noise in the crowded streets.

3. The traffic in cities will not be as congested, owing to the saving in room now occupied by the horse. When we consider that there are, approximately, 200,000 horses used in New York city alone, and that a horse increases the length of a unit by nine feet, it can be readily appreciated how great a saving will be effected. Taking the average width occupied by a horse and shafts as 2 feet, it is seen that 200,000 horses occupy about 3,600,000 square feet, or 82.6 acres of valuable street room.

4. When the use of automobiles has become more general, the cost of operation will be reduced. This is true for the reason that, with an increased output of wagons, the price will decrease, and, with the greater use of power, the cost of it for this purpose will diminish.

5. The danger of accident from runaways will be eliminated.

Copper Production in 1898.

The copper production of the United States in the year 1898 was the largest ever recorded in a single year. The figures, as furnished by the producers for "The Mineral Industry," Volume VII., show a total of 535,900,232 pounds of fine copper, which was an increase over 1897 of 34,529,937 pounds, or 6.8 per cent. The ratio of increase was about the same as that shown in 1897 over 1896, but was considerably less than that reported in 1896 over the previous year. There was imported into the United States during the year 38,922,552 pounds of copper, this metal coming chiefly in the form of copper matte and copper bullion from the mines of Mexico and British Columbia, sent to this country to be refined. On the other hand, the exports for the year amounted to 299,765,054 pounds, or about 55 per cent of the total production. The consumption, as arrived at approximately by these figures, showed very little change from that of the preceding year. During the current year, however, the production has increased but very slightly, while the consumption has grown on a large scale.—*Engineering and Mining Journal.*

OUR CANADIAN LETTER.

TWEED, ONT.—The installation of electric lighting is being considered.

SHELBOURNE, ONT.—The council is considering the question of installing a municipal lighting plant.

ALMONTE, ONT.—Mr. Ritchie is said to be considering the question of installing a 500-light incandescent electric light plant.

LORETTE, QUE.—The Lorette Electric Light Company has been formed here, to light the village by electricity; capital, $10,000.

AYR, ONT.—W. D. McNair, of New York, and J. S. Clarke, of this town, are promoting an electric road from this town to Berlin.

ARNPRIOR, ONT.—The council have appointed a committee to learn on what terms the electric light company will dispose of their plant.

MONCTON, N. B.—The Street Railway Company have plans prepared for considerable extension to their system and the establishment of a park on the outskirts of the city.

BEAR RIVER, N. S.—The people are trying to secure the construction of an electric railway, five miles in length, to connect this town with the main line of the D. A. R. Railway.

OTTAWA, ONT.—The Senate have reduced to two years the time allowed the Ottawa Street Railway Company to extend its lines to Bell's Corners.

GUELPH, ONT.—Messrs. Carscallen and Wingate, of Hamilton, are said to be endeavoring to interest New York capitalists in the construction of an electric railway from that city to Guelph.

BARRIE, ONT.—The Royal Electric Company is said to have made application to the council for a franchise for an electric railway between this town and Allendale, with right to extend it to other points.

KAMLOOPE, B. C.—The council will employ an expert to report on the advisability of purchasing an entirely new plant for the electric lighting of the town, the one now in use being of insufficient capacity.

LONDON, ONT.—A deputation from this city recently waited upon the government at Ottawa and asked for a subsidy to raise the construction of an electric railway from this city to Goderich, a distance of 66 miles.

HULL, QUE.—The city is without electric lighting, the council having not yet awarded the contract for a civic plant, although tenders were received some months ago. On account of the pending law suit between the Hull and Ottawa electric light companies, the council has been slow in taking action.

NIAGARA FALLS, ONT.—A by-law to raise by debentures the sum of $71,000 for the purchase of the Niagara Falls Electric Light Company's plant by the town was carried on last Thursday. The power will be utilized in the day by the Ontario Silver Plate Company, who have decided to remove their works to this town.

QUEBEC, QUE. — The Canadian Electric Light Company expect to commence work on the developing of the water-power of the Chaudière Falls, for which plans have been prepared by J. M. McCarthy and by T. Pringle & Son, of Montreal. The project includes the construction of an electric railway. John Breakey has been elected president.

OTTAWA, ONT.—The bill of the Ottawa Suburban Railway Company was before the Railway Committee of the House of Commons last week. Geo. E. Kidd, representing the company, said that the railway would extend along the canal reserve to Hog's Back and Graham's Bay, with lines across the Ottawa to Kingsmere, Meach's Lake and Chelsea.

HAMILTON, ONT. — The Cataract Power Company is reported to have finally secured control of the Hamilton Street Railway, and will probably hasten the construction of the proposed electric roads to Guelph, Galt, St. Catherines and other points, but it is reported that, owing to the large demand of iron, it will be impossible to secure rails before next Spring.

MONTREAL, QUE.—The Montreal Belt Line Railway Company are applying to Parliament for the power to issue securities to the amount of $4,000,000 for the construction of the Montreal section of the company's proposed system, also to issue bonds to the extent of $300,000 for each bridge it has authority, across the Ottawa and Prairie rivers, also debentures for $1,000,000 for docks, elevators, buildings, etc. The company also asks power to construct the following extensions: An extension of the main line from St. Anne de Bellevue to a point on the Canada Atlantic Railway at St. Justine; an extension of the main line from Bout de l'Ile, in the parish of Pointe aux Tembles, to the town of Joliette to a point on the Great Northern Railway; a branch line from a point on the St. Justine extension to the town of l'Assomption; a branch to the village of Rowdon, in the County of Montcalm, passing the village of St. Jacques.

Montreal, July 20. J. A. C.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

NIAGARA FALLS, N. Y. — The Niagara Falls Telephone Company has been incorporated; capital stock, $100,000. The points to be connected with the city of Niagara Falls are the towns of Lewiston and Porter, and the villages of Lewiston, Youngstown and Lasalle. The directors are Samuel B. Rawson, Fred H. Sudro, James A. Dake, Irving H. Griswold, of Elyria, Ohio; William R. Campbell, James E. Rock, Alan H. G. Hardwick and Walter A. Horne, of Niagara Falls.

ANACORTES, WASH.—The Sunset Telephone and Telegraph Company is constructing a line from this city to Coupeville, Whidby Island. The new line will be 32 miles in length.

ST. MARYS, PA.—The Elk Telephone and Telegraph Company has been incorporated; capital, $20,000; incorporators, G. W. Boyer, C. G. Wilson, A. L. Blaisdell, B. E. Wellendorf, A. Kaul, all of this place.

CINCINNATI, OHIO — The Ohio Postal Telegraph-Cable Company has been incorporated; capital, $100,000; incorporators, F. W. Conger, L. W. Ross, A. M. Beatty, all of this place, and others.

CHEYENNE, WYO. — The Postal Cable Telegraph Company, of Wyoming, has been incorporated; the capital stock is $50,000. The company proposes to commence at once the construction of a telegraph line from the Wyoming-Colorado line to this city, connecting at the boundary line with a line from Denver, and from this city to Salt Lake City, Utah.

INDIANAPOLIS, IND.—The Hartford City Central Union Telephone Company has purchased the Dunkirk-Pennville independent telephone lines, connecting Nottingham, Pennville, Dunkirk, Millgrave and Hartford City, built by Hartford City capital.

GUTHRIE, O. T.—Secretary Jenkins has issued a charter to the Central Telephone Company; capital stock, $10,000; the incorporators are B. F. Marsh, of Dover, president; —— Weltz, of Keil, vice-president; A. M. Mead, of Kingfisher, secretary; W. L. Taylor, of Dover, treasurer; Frank Cronkhite and John Wahling, of Keil. The principal place of business will be at Kingfisher.

PITTSBURGH, PA.—A charter has been issued at Harrisburgh to the Home Telephone and Electric Company, of Pittsburgh, with a capital stock of $100,000. The directors are Thomas B. Lee, Harry T. Van Ostrand, John S. Scully, Jr., John E. Black and John McD. Lee. The company will operate in opposition to the Bell company, and has for its immediate object the connecting of independent telephone companies in Arnold, New Kensington, Parnassus, Oakmont, Verona, Wilkinsburg and other neighboring towns, with a complete long-distance service. The company will, it is said, extend its lines to Pittsburgh. It is expected that the company will be ready for business by January 1 next.

SISSETON, S. D.—The Dakota Central telephone line is now being extended from this point northeast to White Rock. This will give Sisseton telephone connections with Minneapolis and St. Paul.

BALTIMORE, MD.—The new telephone line in Cecil County will be rebuilt, and connections made with the lines to Baltimore and Philadelphia.

LONGVIEW, TEX. — The Longview Telephone Company has been incorporated; capital stock, $10,000. Purpose to own, operate and maintain a telephone exchange in Longview and a telephone line from Longview to Timpson, Tex.

MARYSVILLE, OHIO — Right of way has been secured for a telephone line between this city and Broadway, Richwood and Prospect, and work will begin next week.

FARMINGTON, ILL.—The Farmington Telephone Company has been incorporated; capital, $500; incorporators, J. W. Connelly, F. S. Vandersloat, A. H. Fash.

PUEBLO, COLO. — The Colorado Postal Telegraph Company has been incorporated; capital, $100,000.

KILLBUCK, OHIO—The Killbuck Telephone Company has been incorporated; capital stock, $5,000; incorporators, D. R. Welker, C. C. Carpenter, J. J. Day, J. E. Duncan and Henry Kosner.

CENTREVILLE, TENN. — Arrangements are being made for the establishment of a local telephone system here.

WEST CHESTER, PA.—The Chester County Telephone Company has commenced the work of connecting with other points and within a short time will have lines working to Norristown, Phœnixville, Spring City, Pottstown, Coatesville, Downingtown and probably Parkesburg. A line to Media is to be built by the same company and this will give communication with Media, Chester and Wilmington.

New Incorporations.

NEWARK, OHIO—The United States Telephone Manufacturing Company has been incorporated. The capital stock is $10,000, held by Frederick A. Churchill, Jr., Arthur F. Garesche and William G. Lackey, incorporators.

KITTERY, ME.—Rhode Island Liquid Air Company has been incorporated; capital, $1,000,000; incorporators, George J. O'Doherty, of Boston; Jerome O. Smith, of Arlington, Mass.; F. E. Rowell, of Kittery, Me.

DOVER, DEL.—The Wilmington Electric Plating Company, of Wilmington, Del., has been incorporated; capital stock, $25,000.

NEW YORK, N. Y.—The Falcon Electric Manufacturing Company has been incorporated; capital, $50,000; directors, Edward Leissner, H. O. Swoboda of New York; L. E. Prorup, of Brooklyn.

PIERRE, N. J.—The Passaic Chemical Light, Heat and Power Company, with a capital of $350,000, has been incorporated; incorporators, Charles H. Gage, E. L. Squire and W. L. Shunk.

JOPLIN, MO.—Several New York financiers have formed a syndicate to unite with the Southwest Missouri Electric Railway to extend this line to Central City, Empire, Duenweg, Oronogo, Neck City and other mining camps in the Missouri-Kansas zinc belt. The Southwest Missouri line now reaches from Carthage, Mo., through Lakeside, Carterville, Webb City, Prosperity and Joplin, Mo., to Galena, Kas., covering a distance of 34 miles; the road to be standard gauge, and will be used for freight as well as passenger traffic.

DUNKIRK, N. Y.—It is rumored that a stock company, capitalized at $30,000, will be organized in this city, and that they would ask for a franchise from the Common Council to build an electric railway from Union Depot to Hickoryhurst.

New Electric Railways.

GREEN BAY, WIS.—The McCartney Electric Street Railway and Power Company has been organized. The officers of the new company are: President, T. J. McCartney, Chicago; vice-president, Frank Schoenfield, Green Bay; secretary and treasurer, J. H. Taylor, of Green Bay.

DETROIT, MICH.—The Detroit Municipal Railway has been incorporated; capital, $25,000; incorporators, H. S. Pingree, E. G. Stevenson, J. C. Hutchins, all of Detroit.

BATH, PA.—A charter has been granted to the Bethlehem & Siegfried Street Railway Company for a trolley road from Bath to Siegfried's, a distance of seven miles.

SPRINGFIELD, ILL.—The St. Louis & Belleville Traction Company has been incorporated. It is proposed to construct a line of railway from the east end of the city of Belleville to and through East St. Louis, and from Collinsville to French Village. The incorporators and first board of directors are John A. Day, Edward Abend and G. R. Barrett, of Belleville, and H. W. Tinker and G. Kobusch, of St. Louis, Mo. The capital stock of the company is $1,500,000 and the principal office is to be located at Belleville.

WILLIAMSPORT, PA.—The trolley road between this place and Montoursville is to be extended to Watsontown, a distance of 18 miles. E. A. Lennis, of Philadelphia, is at the head of the project.

Electric Light and Power.

PLYMOUTH, IND.—The M. W. Simons Light and Power Company has been incorporated; capital, $30,000. The directors are M. W. and Ellen B. Simons and Rollo B. Oglesbee.

HARRISBURG, PA.—The Harrisburg Light, Heat and Power Company has been incorporated to supply light, heat and power; capital, $2,000; incorporators, E. Z. Wallower, W. O. Bishop, H. Cohen, T. H. Heist, E. B. Mitchell, all of Harrisburg, and others.

LAKEWOOD, N. J.—The Lakewood Water, Light and Power Company has been incorporated to furnish light, heat and power, ice water, etc.; capital, $150,000; incorporators, Frederick H. Green, Wm. H. Blair, Carroll P. H. Bassett, all of Summit, N. J.

MECHANICSBURG, OHIO—An electric light plant is to be established here.

BLISSFIELD, MICH.—It is reported that a $10,000 electric light plant is to be established here.

RICHMOND, VA.—The Portsmouth Electric and Gas Company, a corporation recently chartered, composed of local capitalists, has bought the plant of the Citizens' Light, Heat and Power Company, and will double the capacity of the works.

Increase of Capital.

CHAMPAIGN, ILL.—The Urbana & Champaign Railway, Gas and Electric Company has certified to an increase of capital stock from $250,000 to $500,000.

The World's Telephones.

I give below, says Edward D. Winslow, United States Consul-General at Stockholm, writing to the Department of State, statistics in regard to the telephones in use in the different countries of the world, which have been carefully prepared by the statistical department of Sweden:

Countries.	Number of Instruments in Use.	Distance Covered, Miles.
Sweden (1897)	56,500	74,568
Norway (1897)	20,678	33,481
Denmark (1895)	10,500	9,321
Great Britain and Ireland (1894)	69,645	83,401
Holland	8,000	4,971
Belgium (1895)	9,227	16,235
Germany (1896)	151,101	147,093
Austria (1896)	21,616	46 375
Hungary (1896)	10,293	17,940
Switzerland (1897)	28,846	47,594
France (1894)	27,736	63,230
Italy (1896)	11,991	13,049
Spain	11,038	14,282
Russia	18,495	40,391
Japan	3,252	5,262
Philippines	452	592
Algiers	335	224
Tunis	200	281
United States (1896)	772,627	825,711
Cuba	1,818	1,181
Canada (1898)	33,500	44,020
Mexico (1896)	9,000	11,807
Uruguay (1896)	3,269	8,117
Total, including nine countries not mentioned	1,288,163	1,509,499

The New Illinois Telephone Company, of Chicago, will go into business with a capitalization of $5,000,000 four and one-half per cent 10 to 20-year gold bonds and $5,000,000 capital stock.

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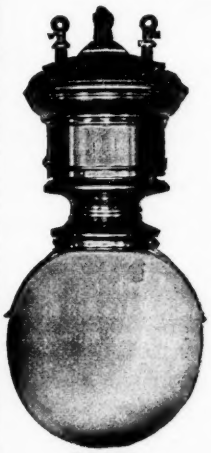

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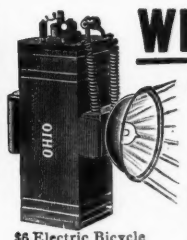

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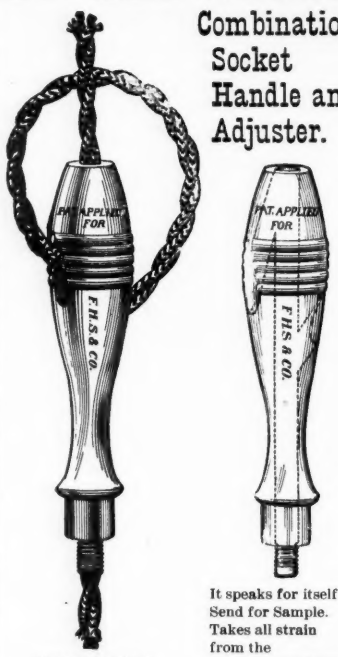

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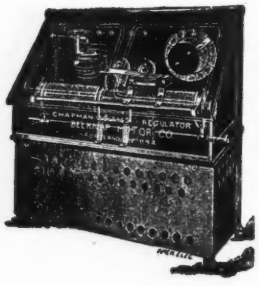

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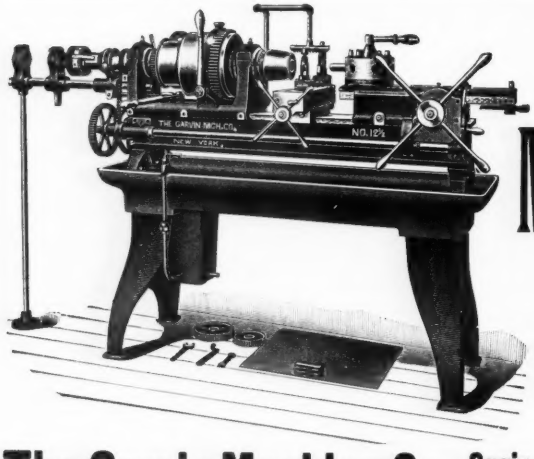

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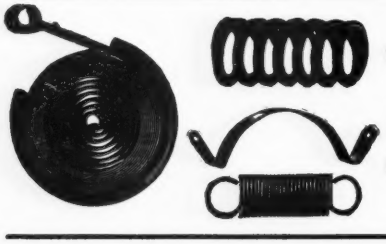

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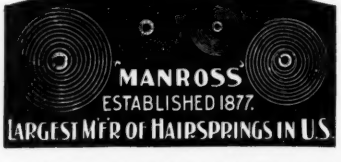

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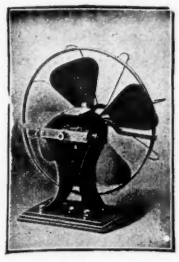

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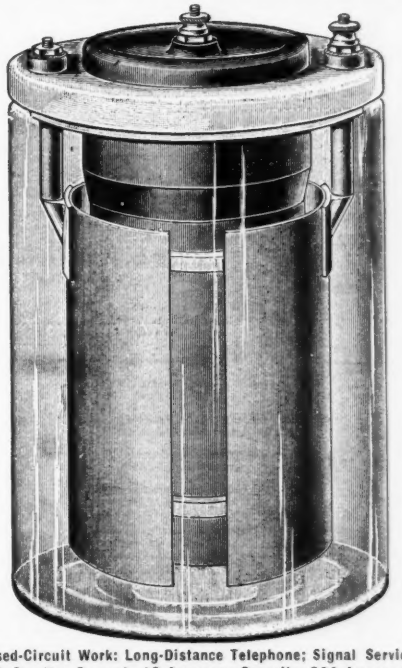

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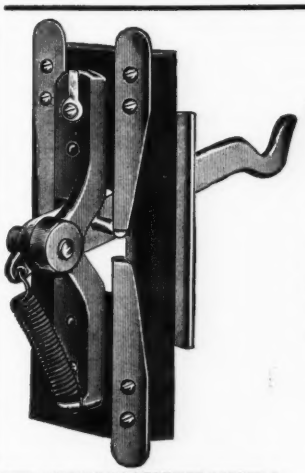

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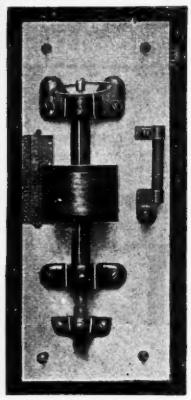

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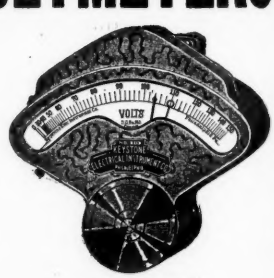

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